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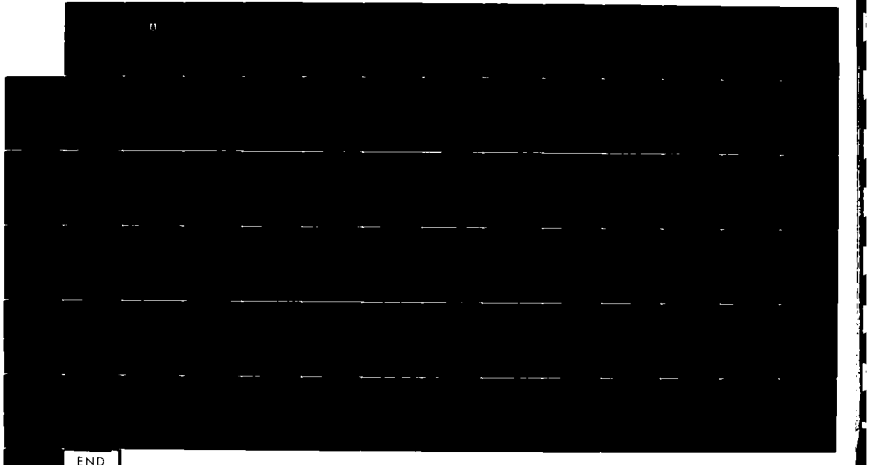

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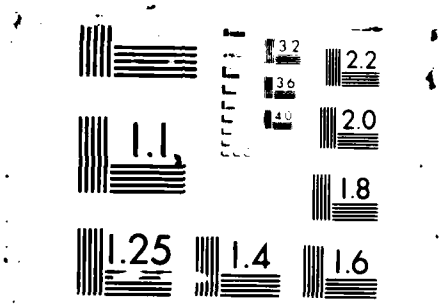

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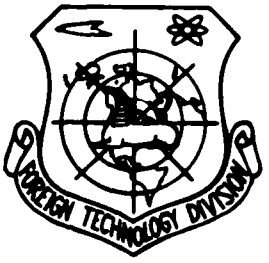
FOREIGN TECHNOLOGY DIVISION

MINISTRY OF ORDINANCE INDUSTRY STANDARDIZATION WORK

(Selected Articles)



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GRAPHICS DISCLAIMER

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EDITOR'S EXPLANATION

This material was assembled to go together with "A Presentation of the Work of Standardization in the Weapons Industry." Standardization is a product of industrialization and modernization. In the process of the modernization of management and industry, it is a basic technical task, and it has already become a basic task which must be firmly grasped by engineering and technical personnel as well as a type of basic knowledge which must be thoroughly understood by management personnel. To accomplish this, we have consulted a number of standardization publications, articles and textbook essays, as well as other similar materials in order to extract the relevent contents which have strong practical applicability and universal significance. These we have compiled into a handbook. Because time is short, it is hard to avoid failing to mention many of the references we have used.

This article was taken from the reference materials of the 1980 conference on work quality in the weapons industry. The heading of this article was, Standardization and Quality Control." It was taken from a portion of a work by the standardization research center. In using it on this occasion, we have made the necessary revisions.

STANDARDIZATION, QUALITY CONTROL, AND THE MODERNIZATION OF PRODUCTION

1. Standards and Standardization

Standards are basically unifying technical principles which apply to all the various realms of production activity to include industry, agriculture and commercial products, engineering construction, environmental protection, safety, health, and so on. They are concerned with providing a common basis for production, construction, and the various different aspects of work.

The concept of standards is a broad one, existing in all the various aspects of society. It is used in order to provide objective principles for measuring things. Because of this, in the various realms of social activity, there are large numbers of things which contain the idea of standards. This is something everyone knows. Standardization is one part of the numerous implications of standards. It is a discipline in the world of science, having its own distinct scientific content. Due to the fact that standards exist in the production activities of society, they follow along with social progress, increases in the level of science, technology and the material and cultural life of people, and continuously develop and improve. Because of this, in standardization there are implied new principles, new methods, and new scientific content. This is an objective rule in the development of things. Any person who takes a static method of thinking in order to view standardization is out of accord with the rules for the development of things. Such a practice can only have a bad influence on the development of standardization activities.

Viewed from the point of view of their nature, standards are a type of policy, a type of yardstick for the measuring of quantities, a type of symbol for recognizing the different characteristics of things, or they can be a type of procedure, principle or method for choosing the best among things. To summarize, they are man made principles for the work of production, and they basically take the form of "software."

Standardization is the directing of people in production and construction to carry out, in a broad manner, a synthesis of the results of scientific research and practical experience, forming common principles (standards), for the universal execution of activities. Speaking in concrete terms, standardization is nothing except purposefuly taking the scientific and technical results from references on various subjects such as industrial, agricultural, and commercial production, communications and transport, construction, health, environmental protection, and scientific and technical intelligence, as well as practical experience, and making a real synthesis with broad discussions of the research. In this way, we form principles for the measuring of certain objects (standards) which are commonly preserved throughout the production, circulation, and exchange of the society in all its sections, in order to arrive at the best activities for developing production strength.

Standardization extends to nearly all the sections of the economy of our country. It also enters into all realms of science and technology. Moreover, it is an important constituent part of the modernization of management. This then determines the scientific nature of standardization. Standardization takes as its object the large number of recurring things with repetitive characteristics which one finds in production activities. On the basis of the principles of "unity, simplicity, coordination, and optimization", the carrying out of research on how to organize and implement the science of standards is a very important peripheral field of study, which runs right through science, technology, economics, and the study of law.

A high degree of development in standardization, as is the case in many fields of study, touches on a wide range of subjects and is complicated in its contents. There are not only questions of natural science involved, but there is also a close relationship to economics and the study of law. Quite a few comrades have taken questions of standardization and considered them only as technical problems in production. This is a very incomplete approach and is not advantageous to the development of the work. It contains not only questions of natural science but also of economics and law and is a comprehensive peripheral field of study.

The association of standardization and the natural sciences is determined by the large amount of scientific and technical material contained in many standards. Every technical characteristic in a standard is decided on the basis of the scientific and technical situation in each period. They reflect such sciences as chemistry, physics, geometry, medicine, and biology in manifesting their materially useful value. A good product reflects an advanced technology and advanced standards. In the same way, it is only with advanced standards that one can induce the production of advanced products. For example, in the smelting of high quality steels, one must first have an advanced smelting technology. The various technical factors in the standards for high quality steels are determined from smelting technology, and an advanced smelting technology is reflected in the standards. In the same way, what the capabilities of a machine are like is determined by design skills, the quality of materials, and the advancement of the industrial arts. Standards are nothing but a reflection of these factors. One can see that the relationship between the natural sciences and standardization is universal, and noone can doubt it. This has been generally recognized.

Let us consider the question of economics and standardization. What could be called the focal point of economics forms around the question of the effects of economics and its meaning for research into savings in material production. Pursuing the objective of standardization and, in doing this, achieving optimum economic beneficiality is in line with the objectives of economic research. The economics of standardization are principally concerned with researching the rationality of various factors in the forces of production from the angle of the economics of technology; that is, from the aspect of the economics of the forces of production, and, in so doing, raise the economic effectiveness and develop productive power. The contents of technical economic research into the forces of production are very broad. They include research into the profitable integrated use of

labor and natural resources, social products and science and technology. These contents also include research into the economic and technical structure of the people of our nation, the economic basis and limitations on the transformation of technology, etc., etc. The focus of attention is the adequate direction of the effective use of resources, products and technology, striving to attain maximum economic results and to promote a high degree of development in the economy of our nation. The focus of attention of standardization and the focus of attention of technical economics are basically the same. Standardization, if it is only viewed from the angle of the natural sciences, is only capable of attaining effective results which pertain to technology. Technical results are the foundation of economic results; economic results are the end product of technical results. When one analyses the economic results of carrying out standardization, in reality, one is doing an analysis of economic results from the point of view of technology in order to increase and develop the service of the forces of production. When one does technical economic research into the factors of the forces of production, one cannot separate it from science and technology It is necessary to make use of the achievements of science and technology, which, of course, includes achievements in standardization. Because of this, the technical economic characteristics which standardization possesses are of the technical economic catagory and also of the economic category.

Let us consider the legal questions of standardization. In order to do research on the resolution of this problem, it is necessary to understand the whole process of standardization. The establishment of standards is concerned mainly with research into the resolution of problems in the areas of the natural sciences and technical economics. However, once standards are announced, legal problems then present themselves. Once standards are promulgated, it is necessary to

strictly carry them out. This is a legal matter. The eighteen articles of the "PRC Standardization Control Regulation" promulgated by the State Council point out that, once a standard has been accepted for promulgation, it is a technical regulation with legal force. At the various levels, production, construction, scientific research, and design management departments, as well as enterprises and project units must all rigorously carry them out so that no unit arbitrarily changes, raises or lowers a standard. Persons whose violations of standards cause bad after effects to include serious accidents must, on the basis of the details of each case, be assigned more or less severe criticism, discipline, or economic sanctions, leading ultimately up to legal responsibility.

If we look from the angle of the nature of standards, standards are a technical and economic composite. They have a dual economic and technical nature. When we establish a technical standard, we must make use of many types of technology and science. For example, we establish technical standards for horizontal boring machines. What type of alloy structural steel should be selected for the major parts of the boring machine? It is necessary to make use of the theories of the science of metal materials and metallographic heat treatment. We specify the smoothness of the main axis of the boring machine, the tolerance on the operating surface of the main axis, the precision of the main axis and its inspection method. It is necessary to apply the science of tolerances and technical measurements. Among the dimensional parameters of horizontal boring machines, there are bore axis diameter, bore axis conic apertures, bore axis travel, flat spin platform slide block travel, length and width of the operating surface of the work platform, and so on. In order to specify these parameters, it is necessary to use the sciences of machine tool design and machine tool kinematics. Only when the maximum supported load on the horizontal bore operating platform is great do such conditions apply, but then, it is necessary to use the principles of the mechanics of materials. The

main horizontal bore parameter - main axis diameter - has numerical values of 63, 80, 100, 125 (mm) which are arranged in relation to each other by a common ratio of 1.25. In conformity with the optimization number system, it is necessary to make use of relevant elementary and high level mathematics. If we perform optimization while specifying the parameters mentioned above, then, it is also necessary to use optimization methods and operations research. One can see that, in specifying standards, one encounters many types of the newest results from the natural sciences. This is the technical nature of standards. However, the specification of standards is certainly not simply a technical problem. It must also involve a series of economic questions. It is very obvious that a standard which is technically advanced but which is economically unreasonable can certainly not be considered a good standard. Because of this, it is necessary to calculate the economic results of carrying out standards. Therefore, one deals with capital, production expenses, production costs, price, wages, profits, fixed assets, losses, depreciation, circulating capital, production cost-profit ratio, capital-profit ratio, amortization period, and so on, and so on. This requires the utilization of the sciences of statistics, accounting, business management, industrial economics, technical economics, political economics, and other economic disciplines. This is the economic nature of standards.

Generally speaking, among the contents of standardization, we find product standardization. This includes product quality, product form, product type specification series, interchangeability of product parts, and so on. In the standardization of inspection methods, we find included standardization of packaging, standardization of technical terminology reference materials, standardization of construction design and members, environmental protection standardization, standardization of industrial arts, tools and

[illegible] standardization of production operations, standardization of [illegible] management systems, and so on, and so on. Product quality standardization is nothing other than, on the basis of the results of [illegible] production and actual utilization, to set [illegible] standards and to put them into practice in order to [illegible] quality. From the various types of seeds used in agriculture [illegible] industrial products like chemical fertilizer, agricultural [illegible] chemicals, plastics, steel, coal, petroleum, cement, lumber, textiles, [illegible] industrial products, electronic equipment, etc., etc., should [illegible] their qualities standardized. Standardization of product forms [illegible] dimensions is, then, the setting of rules for the form and [illegible] dimensions of various products and the enforcement of them. The [illegible] specifications series for types of products is, in like types [illegible] parts, on the basis of optimization principles, as well as their different [illegible] and appropriate uses, to arrange reasonable [illegible] part types and specifications in order, as much as possible, to satisfy many types of requirements with a small number of product types [illegible] parts, that is, the aim of the smallest number of part types as possible to fit many types of products, making use of mass production, maintenance and repair, raise the labor-production ratio and lower [illegible] costs. The standardization of inspection methods is the use of scientifically unified product inspection methods in various areas. Different products should have their packaging standardized in order to [illegible] their quality and increase selling price. The presence or lack of standardized [illegible] terminology reference materials is related to the extension of products, science and technology, and, when thoroughly practiced, can reduce confusion. Standardization of construction [illegible] elements is the foundation for actualizing the industrialization of construction. Once carried through, it has very great benefits for the speeding up of construction. The standardization of environmental protection, in guaranteeing the health of the environment, protects people's lives and property and prevents losses. It raises the quality of people's work. It raises the

labor-production ratio. All these things are extremely important, and it is necessary to resolve ourselves to carry it through. The standardization of industrial equipment, operations, and management systems guarantees the stability of production, raises efficiency, is an important element in guaranteeing quality, and it is only by the carrying out of standardization in this respect that production quality is guaranteed.

2. The Relationhip Between Standardization and Overall Quality Control

Standardization and quality control are two extremely important problems for the scientific management of modern projects. The two mutually affect each other, mutually support each other, and help each other to be successful. Their relationship is extremely close.

If their is no standardization, then, it is not possible to develop quality control activities. If there is no quality control, then, the realization of quality control cannot be reliably guaranteed. Therefore, people universally recognize that standardization is the foundation of quality control, and quality control is the mainstay of standardization.

At the present time, the scope of standardization work has already developed out from the narrow realm of product technologies in the past to the entire realm of product management. Also, from the realm of product management, it has extended itself to the entire realm of business management. Because of this, it is possible to recognize in the abstract that all commonly followed regulations which are formed from a synthesis made on the foundation of scientific research, the results of reform or practical experimentation may all be called standards. The realization of standardization is nothing except requiring every process, link, work procedure, and operation in all production, business management, and administration--every department and every staff member--to use standards to direct their work, to work

toward a rational utilization of the resources of our country, advanced in technology, economically rational, reliably safe, in order to unceasingly improve the utilization characteristics of products, to constantly improve quality, production costs getting lower and lower, and competitive power getting stronger and stronger. Because of this, it is necessary to have a series of standards in order to control and direct production. This set of standards is precisely the basic content of all aspects of quality control in work.

The overall purpose of quality control is to satisfy user requirements. In our country, user requirements are published through technical standards at various levels or technical documents. The various technical standards fixed for products are set on the basis of user requirements. When enterprises initially develop overall quality control activities, they should initially take the reaching and surpassing of all the various product standards directed as the object of their management struggle. In accordance with the development of science, technology, and product techniques as well as unceasing increases in user requirements, technical standards must go through continuous revision. Each time technical standards are revised, the quality targets for products are raised to a new level and furnish a new struggle objective for overall quality control.

Standards and standardization are the legal form of product quality control.

When the nation carries out state control of product quality, it takes the necessary product quality which must be preserved and uses standards, technical conditions and other similar types of legal models to fix it. Moreover, from state determined, legally defined products, to the system of testing product quality before accepting shipment, the state regulates and defines such documents as the laws on substandard production products and the provisions for sanctions under these laws. Besides this, the state must also specify the legal scope of the jurisdiction of quality control agencies, and so on. Because of this, the state's promoting of standards and standardization is a legal method for the carrying out of the organization and direction of product quality control by the state.

Technical standards are the overall basis for quality control. This is beyond doubt. However, this still leaves a point in question. It still needs to be pointed out that, due to the fact that technical standards touch on a very wide range of areas, it is not possible for their levels to be the most advanced at this time. This necessarily gives rise to the situation where technical standards are lower than user requirements. Moreover, the revision of technical standards is also constantly falling behind the development of user requirements over time. Because of this, it is inadequate to take the technical standards currently in effect as the complete basis for all aspects of quality control. Doing this gives rise to the situation where products are unable to adequately satisfy user requirements. Under this type of condition, according to the "PRC Standardization Control Regulation," enterprises should set up quality control standards which are more advanced than the state standards, or the department standards (specialized standards). These superior quality product standards should be taken as the basis for all aspects of quality control to produce superior quality products in order to satisfy user requirements.

Modern mass production is built on a foundation of advanced science and technology and carried through and completed on the foundation of scientific management methods. In any realm of production, a modern enterprise, if it ignores the work of standardization, and does not go on the track containing standardization of enterprise management and quality control, must necessarily create extreme blindness and confusion, even to the point of creating economic losses. Examples of cases where standardization was taken seriously, sincerely set up and carried through and, as a result, economic benefits were obtained, can be very easily found in every nation of the world and every realm of production. The capability of scientifically explaining standardization is enormous. Ten years ago, the Japanese Department of Standardization, in investigative statistics for 1566 various types of activities, found that, in large scale enterprises carrying out standardization, 78% obtained economic benefits, in medium sized and small enterprises

carrying out standardization, 66% obtained economic benefits, and, in enterprises with high levels of mechanization, carrying out standardization, 85% obtained economic benefits. In 1977, the Japanese shipbuilding industry, due to their adopting for use standardized products in turbines, electrical equipment, instruments, and so on, lowered the manufacturing cost of their ships by 2-3%. The NATO defense ministers have, several times in the last few years, called conferences on the rationalization and standardization of weapons, recognizing that the realization of weapons standardization would make it possible to greatly increase the combat capability of units, and, at the same time, make it possible to avoid duplication of labor in the test production of weapons, saving manpower, materiel, and reducing the costs of national defense scientific research.

The work of standardization is nothing else but the requirement to fix advanced, rational and mutually appropriate technical standards for such aspects of various products as quality, function, product types, and specifications, and, through the setting and implementation of standards, to raise product quality. There is a proverb which says, "Without a rule, you cannot make squares and circles." When we engage in production construction, we must also follow certain technical "rules." Only then is it possible to guarantee quality and make the work correspond to use requirements. These technical "rules" in production construction are none other than technical standards. Quality is not a type of intuitive characteristic, but it is a form of indicating product function. It can also be seen as the effective utility characteristics possessed by certain types of products. The quality standard for any product embodies a unifying of the objective utilization requirements and the conditions possible in production. Quality standards include all factors influencing product quality: product weight, dimensions, physical properties, chemical properties, mechanical properties, antibiotic properties, along with production, utilization, repair and maintenance capabilities, as well as packaging, transport conditons, and so on. These factors, in product standards, are all made into clear and precise regulations. Because of this, in specifying the good and bad of a certain product, in specifying what

the effective usefulness or value of a certain product is, it is important to look at the quality standards pertaining to that product and to see to what degree those standards were actually realized in production in order to reach a determination. Technical standards are a type of common technical basis for those engaged in production construction. They are a criterion for measuring the good and bad of products. Products which reach and exceed standards can be called good products. The opposite are products with no usefulness.

Each one of our socialist enterprises, in its production, must strengthen quality control and effect a combination of quality control and standardization. It will then be possible to obtain good quality results. The practical experience of quite a few enterprises in the development of quality control clearly proves this objective rule. However, among several comrades, the recognition of the relationship between quality control and standardization has been unclear; their handling of it has been inappropriate; they have ignored standardization. Due to the fact that the work of standardization has not caught up to the requirements of quality control, the result has been that one hears talk of quality, but quality cannot be guaranteed. Today quality is good. Tomorrow it turns bad. This is related to the lack of a set of standardized industrial techniques, standard procedures, standard inspection, and so on. Because of this, increased attention to quality control begins with standards and ends with an understanding of them. An adequate recognition of the effective power and force of standardization in quality control is actually the beginning and end of the implementation of standardization in quality control. In this way, it is indeed possible to get clear results in raising quality, increasing the rate of production, lowering production costs, and broadening the sale of products.

Looking from the angle of quality control, standards for enterprises can be broadly divided into two types: one type consists of "procedural" standards (sometimes also called "management standards"). These include various types of procedures, responsibilities, methods, systems of regulations, and so on, and so on, which are established in order to guarantee and increase product quality. The other type consists of "measurement" standards (sometimes also called "technical standards"). This type of standard is principally used in the concrete implementation of standards in industry. They are used to directly measure the quality of work and the quality of products, for example, product quality standards, pre-acceptance inspection standards, and so on.

Strengthening the work of standardization has extremely important significance for the strengthening of quality control and the raising of product quality. Following the development of science and technology, the position of standardization in quality control grows ever more important. Setting standards in work generally calls for these several types of requirements in order to make enterprises conform to standards: (1) Authoritativeness. Standards must be firmly established, rigorously carried out, and must not be discretionary matters; (2) Of the masses. Standards must be established and carried out as a synthesis of the economic foundation and by the action of the masses themselves; (3) Scientificness. Adequate use must be made of PDCA methods of work in order to give the standards established an objective basis; (4) Coherency. Standards in various departments and various areas must be coherent, consistent, and mutually coordinated. At the same time, standards must be neither, "issued at dawn and changed at sunset," nor unrevised for long periods. When standards are revised, it is necessary to consider coordination and consistency with previous and subsequent standards; (5) Clarity and precision. In the writing of standards, contents must be clear and precise and requirements must be concrete. It is not right for them to be abstract and ambiguous.

At present, the creation of products of excellent quality, quickly surpassing advanced international levels, is the principle work of quality control. How should we direct our efforts at standardization in the control of quality and the creation of excellent products? Several enterprises which have had good results have had common experiences, that is, they have set up and firmly adhered to a system of excellent quality standards. First, they made an investigation of the levels of advanced standards in the world, clarifying what advanced levels are and why they are advanced. Second, they carried out a comparative analysis of the products of their own factories, searching out discrepancies, and setting out standards for products of excellent quality. Third, they fix methods measuring how products of excellent quality conform to these standards. Fourth, they fix a series of standards for excellent quality work, for example, standards for excellent purchasing, standards for excellent work procedures, standards for excellent semi-finished goods, and so on. Fifth, they set up high quality industrial techniques which are capable of guaranteeing the attainment of products of high quality. Sixth, through the quality guarantee system, they rigorously implemented the various excellent quality standards discussed above.

Through the grasping of supervisor quality inspections, it is possible to promote the establishment and implementation of standards; it is possible to discover problems existing in standards, supplying data for the revision of them; and, it is possible to make final quality checks and insure that substandard products do not leave the factory.

The department of standardization, taking hold of supervisor quality inspections, must then participate in all aspects of quality control. It is only in this way that it is possible to cause standardization to combine closely with production management and quality control. It must participate in the work of discussing and selecting products of superior quality, and, through grasping this work, raise the quality of products in general. It must grasp the work of designating classes of quality, urging enterprises to ceaselessly raise their quality and attain the existing struggle objectives.

It goes without saying that, both inside China and outside, there are delivery standards (national standards or departmental standards), but all of these are only minimum requirements, that is, 60 percent. Surprisingly, it is not because foreign standards are all higher than ours that our goods often compare unfavorably to foreign ones. What is the reason, then? One important reason is that foreign factories all implement internal control standards. These internal control standards are universally higher than the delivery standards, and their control ranges are relatively narrower. Because of this, the implementing of internal control standards makes it possible to cause product quality to rise and be uniform and stable. Foreign factories resolve 80 to 90 percent of their problems this way, causing their products to have competitive power in international and domestic markets. This is very worthy of our emulation.

Following the development and implementation of automatic technology, we are in the midst of amalgamating the inspection process and the manufacturing process, including the inspection process in the manufacturing process. Because of this, quality control raised even greater requirements for standardization. Not only must the material quality requirements be rigidly standardized, the system software for the simultaneous flow of information, including program languages and industrial programs, all present requirements for high degrees of standardization, promoting the development of standardization.

Postwar Japan introduced large amounts of advanced foreign technology and business management techniques, which caused a rapid development of Japanese industry. Later, following along with the industrial development, they introduced a whole corresponding set of quality control technology. In order to better bring into play their quality control capabilities, they also took standardization as their foundation, and implemented overall quality control. Therefore, in order to cause the work of standardization to permeate every realm of quality control, they suggested that "today's total quality control is nothing but the management of standardization."

3. Standardization and Modernization

What is called modernization is nothing other than the use of modern science and technology to arm the various departments of the economy of our nation. The development of modernization causes science, technology, production, and business management to form the unified process and entity of socialist production. Therefore, changes occur in traditional concepts of production. Practical application demonstrates that in standardizing relevant production management organization, one has already created an important element in the use of people to develop modernization of production. This is also the hallmark of modernization.

The special characteristic of modernization is the socialization of production. Fields of production become ever broader. Division of labor becomes ever more minute. Technology becomes more and more complicated, and its requirements become higher and higher. This requires that the scope of cooperation and coordination become larger and larger. Let us take the production of one simple product. Beginning from the raw materials, it is necessary to have cooperation in work, and only then can one guarantee the smooth execution of production. Only then can one guarantee the ultimate quality of the product. In the production of synthetic fibers, it is necessary to have raw materials which meet standards. Only then is it possible to produce monomers which meet standards. Only when one has monomers which meet standards is it possible to produce good fibers. If there is no cooperation in the work, production by division of labor is difficult to carry out. By the same token, if there are no standards, cooperation in work is extremely difficult to smoothly implement. In the production of a complicated product, from the raw materials to the production of parts and spare parts and their supply, the production extends to hundreds and even thousands of enterprises. In a production process this complicated, what is it that causes them, in the dispersed production of various types of materials and parts, to cooperate and coordinate well enough that product quality is able to satisfy the

requirements of later use or processing and with tolerances close enough to guarantee the smooth assembly of the whole machine? One important factor is standardization which has a very important role to play in all this. Take for example a jet engine. It is assembled from tens of thousands of parts. A jet airplane must be assembled from hundreds of thousands of parts. Moreover, the production of these parts, from the respective amounts of time involved to the percentage numbers for factory production in the various places, must finally be centralized and coordinated. In this type of complicated, multifaceted production composite, it is possible to use systems engineering to set up a good production organization, and, at the same time, one must, on the basis of many and various established and implemented standards, cause the products produced by the various production links and production units to be organically related at the technical level, thus guaranteeing cooperation in the work, precision without error in the assembly of the plane as a whole, and the completed production of the whole plane.

Modernized production is built on the foundation of advanced technology, strict division of labor, and broad cooperation in the work. Highly efficient mass production requires a high degree of unification and coordination in the production acitivities of the society as a whole. Standardization is also an indispensible means of organizing the modernization of production. Through the establishment and implementation of various types of technical standards one takes various production construction agencies from the technical level and unites them organically with such aspects as scientific research, design, production, circulation and utilization, forming a unified whole. This guarantees that the modernization of production construction is smoothly carried out.

Along with the heightened development level of modern science, technology, and administration, the content of the idea of standardization has also developed. Its scope has broadened. It not only includes standardization of such products as are called "hardware." It also includes what industry calls "software." A new product, from its test production to its popularization, must initially draw out diagrams which conform to standards. Only then is there a common technical language. It must initially make use of materials and

components which conform to standards. Only then is it possible to test produce prototypes. Technical standards must be set, and the new product must be successfully test produced. Only then is mass production possible. Operating regulations and safety procedures must be set. Only then can safety be guarenteed in the utilizing of new equipment. It is seen that standardization penetrates into various links such as scientific research, design, production, and utilization. It is basic technical work indispensible to modernization.

The symbol of modernization is the modernization of the means of production, that is, the mechanization and automization of production and the modernization of industrial and agricultural organizations, that is, the specialization and coordination of production. The technical production levels of principal production agencies reach advanced world levels. Amounts of principal products produced enter advanced world ranks. Principal products, of course, are of a quality and have production costs which give them all competitive power in world markets. The gross national product reaches the level of the main nations of the world

From these implications and signs of modernization, one can see that what they mainly reflect is the catagory of economics. Because of this, standardization, which acts as the main constituent component in the management of production, has an intimate relationship with the high degree of production automation, production specialization and coordination, high labor-production ratio, high quality, low production costs, and competitive power on international markets, which have been indicated. A large amount of practical experience, both inside China and abroad--particularly, practical experience in the modernization of production--clarifies and demonstrates that standardization of production in the development of production--the development of production to a certain new stage--also develops standardization to a new level, moving social production forward and promoting the development of modernization in production, reaching a new level of

modernization. One could say that standardization is the epitome of modernization with modernization containing large amounts of standardization factors and abundant standardization content. The better standardization is carried out, the larger contribution it makes to the construction of modernization. The better standardization is, the higher the level of modernization.

The signs of modernization also manifest themselves as specialized cooperation in production, high efficiency, high quality, low use of materials, and the ability to obtain large economic profits through relatively small investments. The realization of standardization is one technical means of reaching these objectives. In modernized countries, the development of specialization of production in industry and agriculture causes production efficiency to be high, materials use to be low, and profits obtained to be large. Standardization has an important function in this. If, in foreign automotive production, the average worker produces approximately ten vehicles every year, it is related to the implementation of standardization in the automotive industry. In modernized poultry raising, realizing the standardization of animal rearing, it is possible, within two months, using only two kilograms of standard feed, to raise a kilogram weight of chicken meat. All this explains the fact that standardization is a constituent component of the modernization of production and management. It is a hallmark of modernization.

Standardization has a positive and important function in the development of the specialization of production. We know that one of the important services or special characteristics of standardization is none other than the promotion of the rational development of products, that is, there must be a rational arrangement to a given type of product, carrying out a reorgnization of those complicated, confusing, backward products which are now produced. We should sift out the ones that need to be eliminated, and simplify and merge the

ones that need to be simplified and merged, creating product series, and raising the level of interchangeability of spare parts. The better the level of serialization of products of the same type is, and the better the degree of interchangeability of spare parts, the larger the scale of production can be made. This is advantageous to the realization of specialization in production and the employment of advanced technical equipment, realizing the mechanization and automation of production. The specialization of production and standardization go together and do not oppose each other. It is only in this way that they are useful to the development of specialization in production. If one only carries out specialization and not standardization, the specialization will find it very difficult for it to adequately exert its beneficial influence, even to the point of creating loss of coordination and waste.

In the development of the modernization of production in our country, due to the coordination of requirements, there has been an appropriate promotion of the development of standardization, and through the practice of establishing related standards in production, productive power has been developed. However, in our economic work, how to develop coordination in order to sufficiently exert the effects of standardization in coordination, has still not been considered by most people and has received insufficient attention. This, in turn, affects coordination, and finally blocks the development of production. This type of thing is still commonly seen. For example, the quality of our raw materials not reaching up to standards affects our processing industries, destroys coordination in work, and creates production setbacks. There are quite a few machine tooled parts which also, due to sloppy enforcement of already existing standards, have dimensional tolerances which exceed the ranges permitted by the standards. Quality is not guaranteed, and this affects the assembly of the entire machine, and it

also brings an effect to bear on the life of the product. If the various production units strictly observed the standards which our country already has to regulate production, that would guarantee coordination and would have a beneficial effect on the realization of modernization.

The appearance of new scientific and technical contributions can certainly not be separated from the accumulated labors of those who have gone before us, and large numbers of these have been developed and raised on the foundation created by the people who have gone ahead of us, that is, science and technology maintain a continuity, and, when adequate use is made of this continuity, it causes new science and technology and new products to develop at an even faster rate. This is a universal law. Standards are the fruits of scientific research. They are the summing up of practical applications. Modernized markets require great changes in the twinkling of an eye. They require the instantaneous production of products required by the market. With widespread assistance from standardization, it is possible to shorten the periods for the design and test production of new products and for production preparations. This is advantageous to the accelerated production of new products. It wins time for us. And, it raises our competitive power in markets.

How to even more quickly design and produce a new type of product, and, after successfully designing and test-producing it, not having to invest even more money and time, thus making it possible to very rapidly go into mass production? One of the keys to success in this is nothing other than making use of standardization techniques, using help from standardization to resolve all clumsy methods of work encountered at any time in the development of new products. There is a definite continuity in the development of science and technology. There is also continuity in the making of a new product. In most situations, it is basically not necessary to design each part by itself, starting from scratch. Rather, one can select related standards which we already have, and so make it possible to save design time and labor, shortening the period for design time and test manufacture. Large amounts of practical application, both inside China and abroad, all demonstrate the truth of this idea.

The power of standardization comes from the effects of quite a number of different areas. Outside China, a number of countries have done a large amount of investigation, analysis, and research, which recognizes that, in carrying out standardization, nations and business enterprises must sometimes carry out improvements and revolutions in such areas as the industrial techniques of production, equipment, and management. This requires the spending of investment capital. However, the value which is created is certainly ten times, twenty times or even fifty times the investment. This type of economic value, with a ten-fold or more return on investment, makes it easy to understand why nations with developed industry and agriculture are willing to expend labor and materials on the area of standardization, in order to receive in return even larger profits. This is the secret of the power of standardization. We should adequately make use of the power of standardization for the four constructive transformations of our country, to create even more material prosperity for our people, and even more value contributing power.

The establishment of internal quality control standards by business enterprises can supplement the deficiencies of national standards. For enterprises with a high level of production technology, it is able to adequately bring into play the effects of the advanced technology of the enterprise, extracting its hidden productive power, producing for the nation even more high-quality products. At the same time, it is also capable of making progress in the revising of national standards, raising the level of national standards and accumulating adequate, reliable data. In this way, it is advantageous for the raising of the competitive power of products and the speedy upgrading of products. It is also advantageous to the opening of all types of reforms in the technology and quality control of enterprises, the transforming of technology, and the selection for use of the new products of science and technology. It makes large contributions to the four transformations.

Outside China, the production coordination in industrially advanced countries is already very pervasive. Moreover, the adoption and implementation of large numbers of standards causes these nations to attain coordination and harmony. Therefore, in developing their economies, they obtain such results as short production periods, high labor-production rates, and low production costs. In markets, they have very great competitive power. As is the case with automobiles produced by the Toyota Motor Co. of Japan, the rate of product series creation and the interchangeability of parts are relatively high, and the product types produced are relatively unchanging. Of the twenty thousand different types of parts for each type of automobile, 80% are produced by different small and medium-size enterprises, rationalizing production, with each enterprise precisely setting advanced technical quotas on the basis of their varying productive powers and technical strengths, specifying precise work plans, raising the rate of equipment utilization, selecting for use and popularizing advanced management methods, raising the level of management, organizing rythmic, balanced production, in order to raise the quality of the automobiles, and to guarentee low production costs. Therefore, they have competitive power in world automobile markets. Their sales markets are very wide. They have developed a superior position, and they have overpowered the U.S. auto industry. At present, our country has 130 automobile production points. This large number is the highest in the world. But, yearly production is only 150,000 vehicles. This is due to the fact that most of the factories produce in small lots, production technology is backward, product quality is bad, production costs are high, and the labor production rate is very low. The eight-ton trucks produced by some factories, when compared with the same type of vehicle produced by the Jinan Automotive Factory, had 20% lower horsepower, 20% higher fuel consumption, and 25% higher production costs.

The construction of socialist modernization is a decisive condition for the future development of standardization. If there is no construction of modernization, the effects of standardization have no place to exert themselves. It could also be said that there is no social position for standardization. At the same time, standardization is also an indispensible foundation for the construction of socialist modernization, and if this foundation is not properly laid, then, the construction of modernization can be thought of over and over again but to no avail, can be determined on but not obtained, can be projected but not fulfilled, can be saved for but never purchased. This, then, is the relationship between standardization and socialist modernization.

Reference materials on the work of standardization, which must be known by administrative, scientific and technical personnel. Internal material. Must be safeguarded.

Standardization Work in the Development of New Products

-"Firmly Grasp the Standardization of New Products and Strive to Create a New Condition of Standardization in the Weapons Industry"
-"Strive to Carry Out the Work of Standardization in the Development of New Products"
-"The Work of Standardization in the Diagramming of Model Products"
-"The Methods and Realization of the Work of Standardizing the Iron Horse Motor Vehicle Product"
-"The Status of the Work of Standardization in the Development by Our Factory of an Electric Meter for Popular Use"
-"Product Design Should Strive As Much As Possible for Interchangeability and Standardization of Spare Parts"

Compiled by the Standardization Research Institute of the Weapons Industry Department April 1986

EDITORS' EXPLANATION

This set of materials was compiled to be used in conjunction with the "Weapons Industry Standardization Work Exhibition." Standardization is a product of industrialization and modernization. In managing the progress of modernization and industrial modernization, it acts as the technical basis of the work and has already become a basic accomplishment which must be firmly grasped by engineering and technical personnel. It is a fundamental branch of knowledge which must be thoroughly understood by management personnel. In order to accomplish this, we have examined a number of standardization publications, articles, and textbook essays, selecting those with strong practical applicability, universal significance and relevent content. We have compiled these into a book. Because of time, we cannot but fail to mention the many contributors and references to which we are indebted.

"Firmly Grasp the Standardization of New Products and Strive to Create a New Condition of Standardization in the Weapons Industry"

Chief, Departmental Standardization Research Institute Wu Qinxin

When the Central Military Committee stipulates that, concerning the construction of the national defense industry, we are to carry out the guidance that "in the shortened war line, the important point which leaps out is to firmly grasp scientific research and speed up renovation," the central problem becomes renovation. In the shortened war line, the important point which leaps out is to firmly grasp scientific research in order to renovate weapons equipment and in order to speed up the renovation of weapons. At present, the weapons industry has made progress in implementing and carrying out the guidance to "unite the military and the people" and to "go to the people to protect the military." Moreover, the best and most positive way to "protect the military" is to renovate weapons and equipment. One could say that, in grasping "renovation", in the broad view, and in the development of military strategy, one has taken hold of the basic link in the modernization of weapons and equipment. Since the central question is renovation, then the standardization of weapons and equipment must necessarily also look to renovation, serve renovation, and revolve very closely around the renovation of weapons and equipment. Then it will be comprehensive standardization work which revolves around new weapons products and the new materials, new industrial techniques, and new technologies used by them in the development of the whole process. Looking back on the practical exec ution and realization of this work in the last few years, we should acknowledge that we should go at the work of standardization from the apsects of laying the foundation, raising the level, looking for benefits, and developing new products.

1. We must organize with all our strength to set design standards for weapons products. We must first set up design models and basic technical requirements which must be adhered to in the design of new products in order to put out a unified controlling regulation. After this, we must edit a book of diagrams of parts, components and assemblies which are interchangeable or meet typical structures and standards. Then, we should edit a weapons design handbook which summarizes practical experience in the design of new weapons and absorbs advanced foreign design thinking and design methods.

2. We must conduct scientific research centering around new products and speedily establish basic standards for new products. During the process of the test production of new products, it is necessary to prepare fundamental standards such as product nomenclature, diagram symbols, code representations, signs and symbols, diagram types and setups, as well as structural elements, and their optimum formation into series, and so on. It is necessary to organize our strength to tightly grasp their establishment.

3. We must organize to establish a property testing method for new products. In order to precisely evalutate the functional capabilities of new weapons products, and in order to rigorously insure the design and production quality of new products, it is necessary to establish a series of property (capability) test procedures (the target range test method, the testing station test method, environmental test methods, and so on) and to set up quality control and malfunction analysis standards. In this way, it is then possible to precisely evaluate and judge new products, and also to supply a reliable basis for the unceasing conquest of existing problems with new products in the process of test production.

4. We must organize to establish protection and packaging standards for new products. Summarizing the results of scientific research on the protection and packaging of new products and absorbing advanced technical achievements in protection and packaging from inside and outside China, we must make and establish a set of standards for protection and packaging of new products, setting up a system of standards for protection and packaging which reaches modern levels.

5. We must establish an optimization system for the basic components, the exterior appendiges, the borrowed components and the principal materials in new weapons products.

6. We must, according to specialty, respectively establish series of weapons component standards. Weapons use standard components, and they should, as much as possible, make use of national interchangable standard components. Concerning the parts of requirements for new weapons products which cannot be completely satisfied by the use of the structures, standards, or capabilities of standard components, it is possible to consider, on the basis of the special characteristics and requirements of weapons and equipment, to establish a system of standard components for weapons use. For example, guns use standard components, their carrying vehicles use standard components, the military use optical instruments use standard components, and so on.

7. We must compile materials on standards used by new weapons products and edit a standardization handbook for weapons

8. We must organize to set up reliability methods standards for weapons products. Concerning the reliability design of weapons products, their reliability analysis, their reliability testing and reliability evaluation, we must set up a series of standards. According to the status of work requirements, it is possible to first set up the reliability standards for basic component and unit systems, for example, the standards for the reliability of fuses. Extending even up to the reliability standards for complicated systems, it is possible, on the basis of a consideration of the concrete situation, to select model products, carry out spot tests, gather experience, gradually set up (words missing)

9. We must do research into setting up management standards for new weapons products. Taking scientific research to guarantee the quality of new products as our focus, we must set up a series of management standards for new products, for example, experimental reports to document derived principles, general regulations summarizing requirements, calculation documents showing derived principles, and so on.

10. We must do research into setting up evaluation standards for new weapons products. Concerning the advanced nature of the new products, their reliability, a comprehensive analysis of their economic characteristics, methods of evaluation, principles which must be maintained, and so on, we must put out a unified regulation. Moreover, this should serve as a guiding document in order to direct us in a precise, rational, scientific evaluation of new products.

In summary, the standardization of new weapons products is a very broad realm of work, and there is a great deal of work to do. In military strategy, there is a need to set up a number of lofty, far-seeing, long-range designs and calculations. However, tactically, we must draw out the practical, and make our way forward one step at a time. Of course, one must first select the breakthrough point. One must aim in the direction of the main attack. The starting point must be high, and the advance must be orderly. One must concentrate advantageous forces, one by one, on the breakthrough. The grasping of the standardization of new weapons products is a change in strategy from "after the fact" standardization to "before the fact" standardization, from final standardization to initial standardization, from various separate standardizations to a comprehensive standardization. It is an attempt at the dynamic, systematic standardization of all personnel and processes. It is a change toward giving the work of standardization a fundamental nature. It is not difficult to imagine, on the path of our forward advance, how we might meet with a good number of problems and difficulties. We believe that we have the guidance of the higher level departments involved and their support in aspects concerned. We believe that we have the common efforts of scientific research personnel and standardization personnel and that we will be able to eliminate the difficulties and unceasingly make new achievements. Moreover, we will take these and make a breakthrough, creating a new situation in the standardization of the weapons industry.

"Strive to Carry Out the Work of Standardization in the Development of New Products"

Jialing Machine Plant

Our plant has a history of weapons industry of more than forty years. Before 1979, the civilian products put out at our plant did not account for 5% of the total value of our products. Since the Party's eleventh full "San Zhong" conference, we have decided to resolutely implement the guidance to "unite the military and civilian," and we have tried producing 2.5 horsepower CJ50 type Jialing light motorcycles. Moreover, in a very, very short period of a few years, we have developed one after another a series of new products for the Jialing light motorcycle. During the process of the development of these new products, we, from beginning to end, firmly grasped the development of the work of standardization, causing the work of standardization to be the development of the new products Moreover, the economic benefits which we obtained produced positive contributions. Below is a simple report on several of our methods and superficial conclusions.

1. Standardization in the grasping of plans and the determination of policy

In the past, the standardization work for the development of new products in our plant was always handled only after the stage of the completion of the design documents. The result of this was: "The wood has already been made into a boat." Shall we change it? If we change it, there will be all sorts of difficulties. If we do not change it, we will not meet requirements. In order to turn around this passive sort of situation, we, in the development of this new Jialing Motors product, from the very beginning of our determining its design, positively developed the work of standardization to the point where nothing was done before standardization was carried out.

The height of the degree of standardization of new products has a very strong relationship to the planning and setting of policy in the initial period of the development of new products. Our factory, when it was specifying the design plans for new motor vehicle products, actively sought out the opinions of standardization personnel. Each time there was a meeting, standardization personnel came in full force and participated actively. Our factory treated opinions concerning standardization with relative respect. Moreover, we sincerely researched the various requirements raised by standardization. For example, when we decided on a CJ50B-type design plan, the standardization side brought up the use of a continuity coefficient indicator to carry out the requirement to check up on products. The leadership and the principal design personnel all took the idea very seriously. They did sincere analysis and research and agreed to carry out an attempt at it.

2. Standardization in the design making phase

Standards are the foundation of design work. The quality of standardization work relates directly to the level of advancement and rationality of designs or the lack of those qualities. Because of this, design departments and standardization departments must combine their forces and cooperate.

In the developing of new products by enterprises, design departments must base themselves on conditions specified by policy plans. In the design of the final product, it is necessary to adequately consider the requirements of standardization. Standardization departments should take the initiative and coordinate with design personnel. To help design personnel resolve optimization problems in designs and to cause design personnel to make maximum utilization of currently existing design blueprints, also, to cause maximum possible serialization of current production blueprints, standardization, when it appears to cause the use of parts with similar capabilities, should be considered by design personnel in standardizing dimensional tolerances and so on. In this way, through the cooperation of design departments and standardization departments, it is possible to cause the work of standardization to develop through a normal cycle: establishment--announcement--implementation. For example, we have

set design standards which are appropriate and easy for design personnel to understand. We have supplied a table for the use of basic product materials and a comparative table for the selection modes for materials and spare parts for products of the same type within China. In addition, we have also supplied standards for the materials optimization of product types and the principal capability and specifications data for every type of model of motor vehicle outside China, and we have unceasingly reported materials on development changes. We supplied production blueprints for similar types of domestic products and, in cases worth considering, design books for automobiles, diesel engines and so on, as well as design standard handbooks, basic product part classification handbooks, and so on, and so on. In this way we caused design personnel to be able, in the design of new products, to primarily use their energy and time to take care of actual design work, greatly shortening the auxiliary time for looking up materials, researching articles, and searching for data. Moreover, standardization personnel also helped in supplying handbooks on the utilization of raw materials, spare parts, and semi-finished products, as well as such materials as design books in order to promote the implementation of existing standards in design.

Our factory, in the development of new products, also turned its attention to the investigation of the current situation and market estimates and established a product quality information feedback system. On the foundation of adequate investigative research, we executed production, and took test-produced sample vehicles and sent them to users to be tested. From these checks on product quality, we improved new products and opened up new avenues of development. Market investigation and prediction, product design and test production, materials supply and product production, product sale and repair and maintenance service--these four links use standardization to organize themselves into an organic whole, forming a cycle.

When carrying out market investigations, it is necessary to aim toward the bringing out of a unified investigative program to develop some sort of new product. The general contents are: 1. A comparison of product competitiveness, what the strong points of our factory's products are, including what we should develop in the future. 2. A comparison of product competitiveness, what the weak points of our

factory's products are, including what we should develop in the future. After that, one carries out an analysis and organization of the status of the market organizations. One carries out an organization of the materials collected, and one calculates the life of principal components (engines, transmission boxes, and so on). After that, on the basis of the results of investigations, one specifies items to be improved, and selects the measures for carrying the improvements out. One establishes definitive standards, organizes developmental designs, carries out test production, production, marketing, and so on, with such links forming a systematic cycle.

The process of developing new products is nothing else than the carrying out of a standardization plan. Standardization should permeate the development process from beginning to end.

In order to make every technical and economic indicator of new products advanced and reasonable, satisfying the performance requirements of consumers, it is necessary, as much as possible, to raise the standardized level of new products in the areas below:

1. Take the opinions on improvements in various aspects, which are gathered concerning product quality by the market research structure and put them together to induce implied solutions. Taking the same and similar requirements from different users under different conditions and making them the information content of standardization, facilitate raising the standardization level of new products.

2. In the development of new products it is desired to obtain economic benefits as early as possible. Because of this, one should combine the actual situations of the enterprises in question or of associated management enterprises, in order to pay adequate attention to product continuity, guaranteeing to the maximum extent their possession of the results of standardization, therefore, raising the level of standardization of new products.

3. In order to shorten the design period, as much use as possible should be made of basic product structural elements in order to reduce supplementary design time for cutting tools, clamps, measurements, and molds, as well as reducing the amount of work in manufacturing, so as to obtain faster speed, lower production costs, and better quality in the manufacture of new products with definite competitive capabilities.

4. On the basis of the requirements for the development of new products, in certain sections of redesigning, one should carry out research and analysis as well as unification and induction so as to make necessary simplifications.

5. Attention should be paid to the utilization of the results of technical reforms, optimizing the structure of the constituent parts of new products, and, as much as possible, making parts with similar functions also have similar structures, causing the spare parts system to become serialized.

3. Review of Standardization Before the Completion of Design Regulations

One must quickly and unceasingly develop the preinspection of (two characters unreadable) sketches and technical documents. Along with the carrying out of the test production of products, the creation and arrangement of sketches and technical documents must be developed in all aspects. The work of standardization at this stage must pay attention to grasping "critical moments," and, when the moment arrives, standardization personnel must exert their full efforts to help design personnel resolve problems related to standardization regulations on time. This is particularly true in situations where there are a lot of new personnel making diagrams. Due to the fact that they do not understand enough about the requirements for design documents, there is an even greater need for the timely setting up of specialized classes introducing the relevent requirements. In strengthening the preinspection of diagrams and technical documents, it is possible to avoid, after the carrying out of manufacturing and finisning, a passive situation requiring the readjustment of designs, in order to guarantee the quality of design documents.

In carrying out an examination of standardization before the designation of design forms, it is not only possible to predict the technical level of the industrial techniques in the manufacture of new products, but it is also possible to do analysis and research or to limit the excessively high requirements which designers can raise over and above practical situations. For example, in the preliminary investigation we did in the selection of precise dimensions for the CJ50B product, we discovered that, in the entire vehicle, the parts having tolerance requirements in their dimensions (called tolerance dimensions) were a total of 1481. Among these, those matching corresponding standardized tolerances (called standard tolerance matches) were 1051 or 71% (matching 185 requirements). Tolerances selected on the basis of experience (that is, not fitting standard tolerances) were 57 or 3.9%. Standards not selected according to standard dimensional divisions (called dimensional division tolerance non-matches) were 373 or 25%. Non-coordinated dimensional tolerances selected for use were a total of 830 dimensions. Among these, those machined parts having degrees of precision at the IT11-14 level were 80%. Punched parts were 86%. Plastic parts were 85%. We also discovered that, among the machined parts with non-standard dimensions, there were 5 at the IT5 dimensional level. There was one plastic part at the IT6 dimension level.

During our initial statistical anaylsis, we also took a close look at the selection of form tolerances. We considered a total of 183 elements. Arranging them on the basis of their selection in the order of their number, they were: verticality, coaxiality, mean trip motion, cylindricity, planality. Qualities of these 7 types accounted for 97% of the total all together and respectively accounted for 28% to 6% of the total.

Through preinspections, the process of analytic comparison between new products and basic products is aided, and one reaches a unification and optimization of the quantities concerned.

4. How to develop the work of standardization in practical terms

Standardization activities in enterprises must be intimately related with the actual situation of the enterprise and the technical work of production. Because standardization, in and of itself, has a certain restraining force, in the process of developing standardization, it is necessary to resolutely face the production at hand, seek the facts, and consider the whole situation, taking a rational attitude, with mutual cooperation, in order to seek out unity and promulgate relevant regulations. In order to make technical documents unified, mutually coordinated, guaranteeing the quality of cooperative products, and synthesizing the concrete situation, we take product standardization and divide it into the five aspects set out below:

1. Enterprise standards: standards carried out within the scope of an enterprise.

2. Internal control standards: technical standards for foreign trade goods and goods of excellent quality.

3. Specialized technical conditions: technical conditions governing the manufacture and acceptance of specialized parts.

4. Technical conditions for acceptance inspections: between enterprises, on the basis of manufacturing and acceptance inspections of serialized parts, if a revision is required, it must go through discussion and examination in a technical coordination meeting.

5. Technical agreements: in order to establish a basis for specialized technical details, and, taking as the first requirement the guaranteeing of the basic capabilities of product parts, mutual agreement is required from all cooperating factories. Generally speaking, there is an agreement signed which is effective within the period specified by the agreement.

5. Effecting standardization in technical cooperation

Our factory, in the introduction of foreign technology and the carrying out of technical cooperation, has paid great attention to "the importance of introducing and digesting technology," and "the simultaneous advancement of technology and management." In the work of introducing technological materials and production technology, we firmly maintained, in our selection for use, four principles of advanced standards:

1. The principle of equivalence of selection in the carrying out of product standards and testing methods.

2. The principle of generally equal effectiveness in selection for use of basic standards such as terminology, symbols, tolerances, and plans for the assembly of machinery, as well as international units when considering the Chinese situation.

3. The principle of taking technical conditions and quality indicators which are advantageous to raising the level of production and substituting them into enterprises, to include partially related principles.

4. The principle of generally not lowering standards in enterprises which are higher than foreign quality targets and requirements, except in unreasonable cases.

Due to the fact that we have firmly maintained the four principles above, we have obtained clear economic results and benefits, we have caused products to be greatly improved in their external appearance, we have added safety guarantee systems, we have improved the economic nature of structures and products, and their reliability and durability have also shown clear increases.

6. Several points to be understood in the development of new products

1. Leadership emphasis is the key to standardization work.

In the development of new products, the carrying out of standardization has very great significance for the raising of product quality, for the shortening of the periods of test manufacture, for the lowering of production costs, and for raising economic benefits. However, standardization touches on design, materials supply, manufacturing, marketing, and other similar departments. Results cannot be achieved in all these areas at one time. Also, in this work, we will meet with various types of difficulties. Because of this, the main attention of leadership is on the key work of standardizing the development of new products. For example, once design work has begun on second-generation products, when the factory leadership is working on designs, they clearly announce that standardization personnel are equally responsible for the project, and they require the design personnel and the standardization personnel to combine their efforts and cooperate. The result is that the development of the work of standardization is relatively smooth, and the results are quite obvious.

2. Unified thought recognizes that the obvious target is to guarantee the carrying out of the work of standardization.

Design personnel and standardization personnel ought to form an intimate relationship. In order to make this point clear, standardization personnel must first pay attention to their own responsibilities and position. They must use reason to serve people. They cannot use their rights to choke people off. Their primary motivation must be to serve the design personnel. They must recognize that standardization is not an end in itself, but that it is a type of means or measure to promote the advancement of the work. For example, in order to shorten the assistance time for design personnel, we supply beforehand design reference materials with data on the principal capabilities and specifications of several hundred types of motor vehicles at current foreign levels, various types of handbooks, books of

diagrams, basic product materials, standard components, interchangeable components, components purchased abroad, and so on, to be used as design materials, to cause design personnel to feel all around them the fervent service of standardization personnel. Design work and standardization cannot be separated from each other. Therefore, the establishment of an intimate relation between them causes them to know and become aware of the significance and responsibility of the work of standardization.

3. A thorough knowledge of the work of standardization is an important condition for the completion of that work.

If one wants to carry out the work of standardization, it is necessary to pay attention to the personal development of standardization personnel. Besides taking charge of their own particular standardization work, it is necessary for them to firmly grasp specialized technology and understand production management activities. If this does not happen, then it is not possible for them to speak to the details of an issue or establish the legitimacy of standardization. (Originally carried in "Weapons Standardization" 1964 reprint.)

"The Work of Standardization in the Diagramming of Model Products"

General Engineer, Gao Feng Machinery Plant, Wang Ruifang

Beginning in 1978, our factory began taking responsibility for the mission of diagramming ten types of tools for the drilling and dredging of oil wells. These products were all produced by the U.S. Bowen Company. Their structure was advanced and their capabilities were excellent. Their operation was simple, and they were safe and reliable. Their work efficiency was high, and they were greatly welcomed by oil field workers. Among the new types of standard, serialized dredging tools of the Second Level Directorate of the Ministry of Petroleum, there were twenty types of new tools. Among these, our factory produced 11 or 55%. Looking at the serial numbers already produced, the products of our factory accounted for 45% of the total. Because of this, the model products diagrammed by our factory have made a definite contribution to the development of these products. In the attaining of these results, the work of standardization has played a very great role.

Practical experience over the last few years has taught us that:

1. In the diagramming of model products, it is necessary to strictly follow the standard order for the diagramming of model products, raising the technical management level.

From practical experience, we have put together a standard procedure for the diagramming of model civilian products.

The diagramming of model civilian products and the designing of military products not only have common principles, but also have their special areas. The stress should be laid on the technical design stage. Because of the fact that the principles for the designing of model products are well known, feasibility is tested through practical experience, and design plans are unique. It is only necessary to take a good grip on technical design, and basically, one has laid a

successful foundation for the diagramming of model products. Moreover, operating strictly according to the standard procedure for the diagramming of model civilian products, it is possible to shorten the time period and reduce losses. However, in enterprises in the weapons industry, it is easy to take this point too lightly. Our factory has learned this lesson well. In early 1979, beginning with the technical preparations, the leadership, in order to save time, raised the slogan, "fixed designs and fixed industrial processes carried out at the same time." The result was exactly the opposite of what they intended. Due to the fact that the tool machine shops were unable to supply large amounts of specialized equipment on time, they were forced to make the production machine shops make their own test production using no small amount of substitute equipment. After a period of time, tool units were overstocked by more than ten thousand yuan worth of equipment with no one to ask how or why. These contradictions involving manufacturing industrial techniques, equipment design personnel, tool units and production workshops, frustrate the positive attitudes of design personnel, and, not only create losses, but also, delay the pace of test production, and, to a certain degree, adversely affect market competitiveness.

2. The technical level of standardization of product design personnel is the decisive factor in the work of standardizing the diagramming of model products. Because of this, the carrying out of standardization education and standardization technical training is very appropriate.

The production technology for drilling and dredging tools was a new field for the technical personnel of our weapons industry. At the same time, these foreign products were advertised as so-called "trump card" products, and, to a certain extent, they restricted our thinking. Because of this, when carrying out the diagramming of model products, there are two different types of thinking in existence. One type is to diagram once without variation. The other type is to combine the concrete conditions of our nation and our factory in carrying out the

work of standardization, aggressively improving the various irrational aspects, causing them to correspond to simplified and unified principles, and making these products our own. Going through a certain work and unifying our knowledge, we recognize that it is not our object to totally imitate. Our object is to thoroughly absorb and understand the capabilities and requirements of products, adopting their strong points and combining our own practical improvements from old products to design new products. It is only in this way that it is possible to meet the requirements imposed by technology. Because of this, in design diagramming, during review research into design diagrams, one continuously implements the "three transformations" requirements for the products, guaranteeing product diagram and design quality, and speeding up the pace of test production.

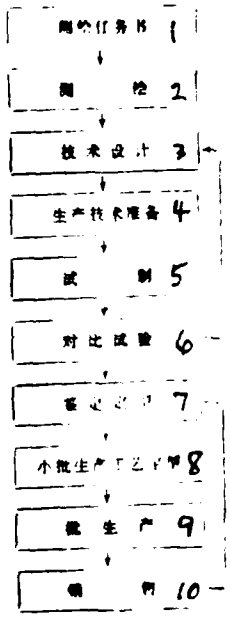


Fig. 1 1. Written Diagram Mission Statement 2. Diagramming 3. Technical Design 4. Technical Production Preparations 5. Test Production 6. Comparative Testing 7 Evaluation and Fixing of Form 8. Small-Scale Production and Fixing of Industrial Techniques 9. Mass Production 10. Sale

1. Unity of Structure

Among the ten products which we diagrammed, the principal parts belonged to the cylinder-sleeve type. Some internal cavity structures were similar. In spite of the fact that, when diagrammed, their internal structural dimensions were different, and the functions and capabilities of the products were different, we recognize that it is only necessary to get a good grasp on the functions and requirements of products produced as well as on the functions of spare parts and it is possible to eliminate the differences existing in the original structures and make them uniform. Taking the cavity sleeves of the YSJ70 hydraulic punch and the YJQ70 accelerator device as an example, after we carried out a good number of revisions and unifications on these two types of products, not only did we eliminate the need for several high precision pieces of equipment, but we also guaranteed product quality, and did a series of test production experiments which were successful. The North China oil fields have used these two types of machine products to cause the elimination of accidents in the last few years and to prepare oil fields which have been declared unproductive. A deputy general engineer was sent on a special trip to explain to everyone that these two types of products, although they have not been accepted in fixed form as yet, must, however, still be used as sample products. Several score were ordered at one time.

2. The Universalizing of Parts

The universalizing of parts causes products to have excellent universal applicability, mutual interchangeability, and is an important link in the standardizing of diagramming and design. It is an important means of carrying out the development of products. As well as the example of the YSJ70 and the YSQ70 mentioned above, direction guide rods are the direction guidance parts for the two types of products, guaranteeing their normal operation. They also are components of the pressure seal structure. The diagrammed dimensions for the direction guide rods of these two types of products and their dimensions and precision after unification are as shown in Fig. 4 and Table 2.

With very small revisions and the unification of dimensions, we made dual purpose components. Besides this, we carried out universalization work on the seal structure components, nut gaskets, shock gaskets, lower connector heads, and other important parts of the same type.

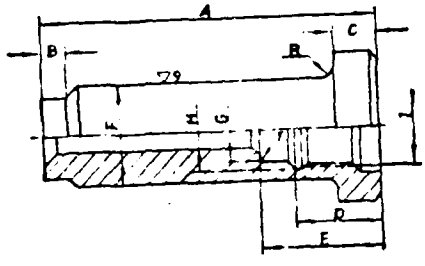


Fig. 2

1 产品零件	A	B	C	D	E	F	G	H	I	R	r
YSJ70-23	509	48	12.5	96.5	117	$\phi 110d_3$	$\phi 87D_4$	$\phi 91.5$	$T90\times 2\cdot 2$	9	4
YJQ70-23	507	60	13	97	116	$\phi 112d_4$	$\phi 88D_4$	$\phi 92$	$T91\times 2\cdot 3$	7.5	0.5
2 改 后	530	50	13	96	117	$\phi 110d_5$	$\phi 87D_4$	$\phi 92$	$T\ \times\ 2\cdot 3$	9	1

Table 1 1. Product Part 2. After Unification

3. Production of Materials in China

In the diagramming of model products, that the materials selected should be domestically produced as much as possible, is another one of the principles of our work of standardization. Due to the fact that

the products introduced are urgently needed for use in the oil fields, it is not permissible to carry out analyses of the chemical components and the physical characteristics of the materials in each of the parts. We, on the basis of the functions of the parts, and, keeping the guaranteeing of product quality uppermost, exerted as much effort as possible to select for use the necessary technical measures to use our set of national standards and avoid the importation of materials. The manuals for the products we have introduced point out that the main materials are high quality alloy steels which go through special heat treatment. The material in the U.S. well drilling tools which were introduced by the Ministry of Petroleum was mostly AISI standard 4140 and 4130 alloy structural steel. The chemical components of these steels are basically the same as those in the Metallurgy Ministry standards 42CrMo, 35CrMo, and 30CrMo. The mechanical characteristics were also similar. Related materials introduced within our domestic well drilling tools were, for the most part, 42CrMo and 35CrMo. Because of this, we selected these two types of materials to be our basic materials. Moreover, for actual parts, we, then, on the basis of differing functional requirements, selected special surface treatment measures such as plating, coating, and carburization.

As far as the material quality of the key components of these introduced products are concerned, besides carrying out the work of comparing the similar standards described above, we must also struggle to obtain the durability of the U.S. products, carrying out analytic tests to obtain reliable numerical data and, later, make a precise choice of materials.

4. The Change to Domestic Production of Serialized Products and Basic Device Components

Due to the fact that U.S. industry is relatively developed, their technical standardization is relatively advanced. Moreover, standards in our country are incomplete. The product types produced from basic parts, their specifications and their relative comparison all leave something to be desired. There are many products the parts for which have capabilities which still await improvement. Because of this, the diagramming of new products contains a large number of problems which are handled by electromechanical serialized products and liquid

pressure components. We recognize that, on the basis of product characteristics, and on the foundation of a well digested understanding, we should give adequate consideration to our domestic serialized parts and their mutual interchangeability systems. It is preferable to partially revise designs, and we must, with the broadest scope possible, search out domestic sources of products or fixed production plants. It is only necessary to choose to use positive, prudent guidance, and it is possible for us to adequately set up domestically to make it not only possible to reduce unnecessary importations, but also, when users do preventive maintenance, to make it easy to find serialized parts, and, in this way, simultaneously advance technical characteristics without being influenced by importations and increase economic benefits.

Model products diagrammed by our factory share in common with the CxT1400 type disassembly and loading test apparatus 1229 parts of 310 types. Among these, there are 720 parts of 96 types which were purchased abroad. Personnel designing these products take these foreign purchased parts and divide them into three types in order to handle them. One type is fastening parts, bearings, generators, and types of high-pressure rubber tubing. All these things correspond to selected domestic standards. Because of the problem of material quality (for example, fastening parts) they are manufactured domestically, guaranteeing quality. Altogether, there are 78 types in this catagory. The second catagory is plunge pumps, sintered filters, self-sealing connector heads, pressure gauges, and so on, for a total of 17 types of products for which there are similar domestically produced items. However, the characteristics of these do not match requirements. We invite cooperation in the improving of factory production, forming a domestic enterprise standards system. The third catagory is multi-path, variable direction valves. Domestic production still lacks the products we need. However, we understand that, in Tianjin, a certain valve factory and a certain research institute are currently engaged in the cooperative test production of a similar type of product. We present the characteristics required and the relevant numerical data, and, we invite them to go into test production. Because of this, within a short time, positive measures will be taken

to turn all parts bought outside China into domestically produced products. The goods supplied satisfy the various technical characteristic targets for the CxT1400 equipment, causing a test production of diagrammedmodel products to be successful. They have been warmly welcomed by users.

To summarize what has been said above, striving to raise the level of standardization of engineering and technical personnel, adequately transferring the initiative from several areas, is the key to completing the work of standardization in the diagramming of model products.

3. Adequately Exert the Initiative of Specialized Standardization Personnel and the Vast Majority of Engineering and Technical Personnel. Establish Standards for Interchangable Technical Materials in Civilian Products and Enterprises. Strictly Adhere to Product Quality Standards. Simplify the Work of Technical Preparations. Raise Management Efficiency.

Standardization personnel should really participate in the entire process of technical work beginning with the product diagramming. This is an important means of implementing the standardization of product design. Standardization personnel should, when diagramming and designing products, clearly bring out in products the requirements of the three transformations , and, it is necessary for them to implement several levels of standards. After technical design, one should strictly carry out standardization inspections and checks of diagrams. Besides checking the status of implementation of the various levels of standards, one should put special inspection emphasis on whether or not broad use is being made of familiar or fixed design plans or structural plans. One should check on the technical characteristic targets and quality targets for products, bring out a standardization inspection report, prepare the necessary product evaluation documents, and present to the responsible leadership suggestions on standardization for the present and the future.

In our diagramming of the $6\text{-}\frac{1}{4}$" model product, along the base of the drill punch device, we also design $5\text{-}\frac{3}{4}$" along the drill. Before designing, the standardization personnel clearly bring out the requirements below:

1. Implement and enforce already promulgated and effective standards of various types.

2. Pay attention to product continuity. To as great an extent as possible, maintain the standardization results from basic products. Newly diagrammed and designed products, on the basis of structure and function, have carried out on them induction, unification and limitation. To the greatest extent possible, selection should be made of standardized and interchangeable parts.

3. O-shaped sealing rings and their sealing structures should select for use the ISO standard.

4. In order to carry out the work of implementing the new national standard "Tolerances and Their Coordination " in the transition phase, one selects for use already standardized coordinating symbols as well as the standardized numerical value method. In industrial process documents, it is possible to simply point out the numerical values of the tolerances.

5. In the diagramming of model products or the designing of series of products, one should implement priority number systems in order to reduce the types of fixed value cutting tool products.

6. Attention must be paid to such things as the tolerances in dimensions, angles, and circular angles, on the basis of a carrying into effect of the technical conditions in manufacturing and preacceptance inspections of petroleum dredging tools.

7. Strict adherence to the product serial number system.

In order to transfer the positive attitude of relevant technical personnel, the spirit of opposing the hindering of production, with each person going his own way, influencing the implementation of standardization requirements for the diagramming of model products, our

our factory also carried out standardization education of key technical personnel to make them aware of directing work according to the principles of standardization. Because of this, the broad masses of technical personnel in our factory are able to positively take the initiative in coordinating with the standardization office, creating factory-wide technical materials or factory standards. Everyone recognizes that the combining of military and civilian requirements is the long-term guidance for the weapons industry, and the establishment of various kinds of universal technical materials for dredging and drilling tools must certainly be carried out. After the designing of the first batch of products is finished, we continually set the universal technical conditions and enterprise standards which are mentioned below:

1) Technical materials for the test production and acceptance inspection of dredging tools 2) Technical conditions for the sealing system of dredging tools 3) O-shaped sealing rings and their structural design principles 4) Technical conditions for the metallic materials used in dredging tools 5) Materials substitution system and charging methods for dredging tools 6) Screw thread connection structure 7) Seal test connector head standards 8) Safety wire standards on dredging tools 9) Universal industrial techniques for product rustproofing, oil seals, and packing 10) Universal industrial assembly techniques for dredging tools 11) Connector head screw thread standards for dredging tools 12) Universal industrial techniques for the phosphorizing of dredging tools 13) Universalization of dredging tools 14) Priority number system (Compressed national standard) 15) Normal screw threads and tube screw threads.

After creating the types of materials described above, we caused the production of civilian goods at our factory to go from diagrams, designs and raw materials into our factory, receiving another acceptance inspection, and then, to finished products, which received another acceptance inspection. From parts processing and assembly to exterior fittings, there were clear and precise quality requirements and acceptance inspection standards. Personnel organizing systems for industrial techniques clearly specified that the technical requirements

for parts and finished products be included in industrial technique documentation. Because of this, we prepared a reliable basis for guaranteeing product quality. The establishment of testing standards provided a basis for the designing of test equipment. The compressing of the priority number system, the reduction in the types of fixed value cutting tools, and reduction in the specifications for types of raw materials, reduced the amount of work for the supply and inspection departments of enterprises and lowered production costs. All of these things increased the speed of diagramming sample products and designing product series. They simplified the work of technical preparation and reliably guaranteed the high speed, high quality production of civilian goods.

5. The Diagramming of Model Products Is Done in Order to Develop Our Own Product Series

According to understandings, the Ministry of Petroleum, between 1978 and and the present time, has spent large amounts of foreign currency to introduce advanced drilling and dredging tools from abroad. Several types were repeatedly introduced. Concerning this question of importation, we recognize that these importations expend funds in order to introduce foreign technology and that this is an important policy for the development of the science, technology and economy of our country. Importations certainly do not explain our inability to do anything. Some of these importations make it possible to save time and money. Experience both inside and outside China proves that familiarization with imported technology, as compared with developing everything on one's own, can save money, manpower, and time several tens of times over. Because of this, after the introduction of products, we should "digest" them very well, in order to very quickly make them our own. We carry out the diagramming of imported products, design calculations and experimental research to absorb these technologies, adopt their strong points, and, on the foundation of this research which has already been done, develop our own new types of products, turning foreign things to Chinese uses. Therefore, the introduction of foreign products is just one method, the purpose of which is to introduce and familiarize us with advanced technology and its results

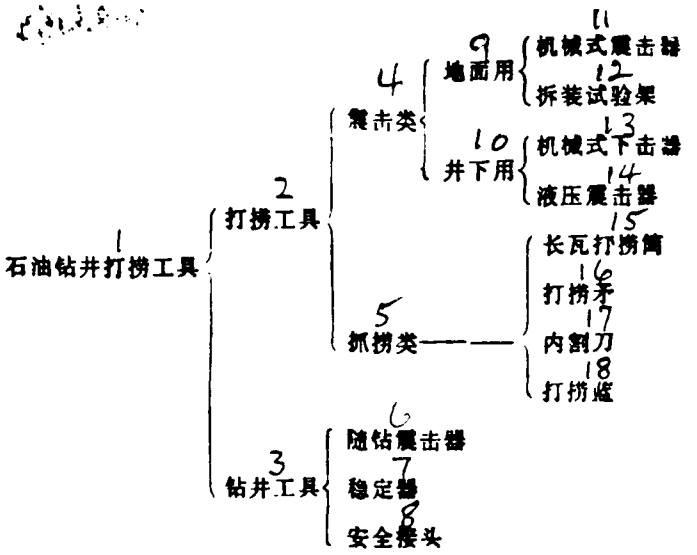
in order to even more rapidly develop the product series of our country.

The oil drilling company of the Ministry of Petroleum has pointed out in its relevant documents that, in order to advance still further the level of competence in dealing with accidents or difficulties, it is, at present, extremely necessary to adequately realize and improve the serialization of new forms of drilling and dredging equipment in order to adequately make felt the effects of these new forms of drilling and dredging tools on the handling of problems and accidents down wells Moreover, it is required that the various oil fields establish serialization standards and strive to succeed in lowering to 6% time lost to well drilling accidents. Because of this, research and development of serialized drilling and dredging tools from our factory is the central task through which our factory is able to originate and make even larger contributions. The timely establishment of series standards for the development of new products, satisfying the requirements of users, and allowing the gradual development of the production of civilian goods and new markets for them, are matters which are all achieved at one stroke.

1. In order to do research on serialization standards for petroleum well drilling and dredging tools, through the process of investigation, the principal tools which are required by the Petroleum Ministry are of the six types below:

Well drilling tools, dredging tools, well shoring tools, well repair tools, experimental equipment, test check tools, and so on.

Our factory produces only two of these types. The spectrum of product types is as shown below:



1. Petroleum Well Drilling and Dredging Tools 2. Dredging Tools 3. Well Drilling Tools 4. Shock Impact Type 5. Scrape Dredging Type 6. Drill Following Shock Impact Device 7. Stabilizer Device 8. Safety Connector Head 9. Used on the Surface 10. Used Down the Well 11. Mechanized Shock Impact Devices 12. Fold Loading Test Bed 13. Mechnized Drop Shock Device 14. Pressure Shock Impact Device 15. Long Ceramic Dredging Tube 16. Dredging Probes 17. Interior Cutting Knife 18. Dredging Basket

In a situation where well drilling and dredging tools are gradually tending toward saturation, the development of well repair tools, well shoring tools, and well measuring tools is already under way.

2. Serialization

In the spectrum of products described above, our factory is still currently only producing dimensional series of the few types shown:

$$6\frac{1''}{4}、7''、8\frac{5''}{8}$$

Investigations show that the dimensional serializations for well diameter and drill bit series as established by our country's Ministry of Petroleum and Geology are as shown below. (See Table 8)

表 8 TABLE 8

井径尺寸 1	钻杆尺寸 2	配接钻锥尺寸 3	配套工具尺寸 4
$6^{3}/_{4}$″～$7^{1}/_{8}$″	$2^{3}/_{8}$″	$3^{1}/_{2}$″	$3^{1}/_{2}$″
$5^{3}/_{4}$″～$6^{3}/_{8}$″	$2^{7}/_{8}$″	$3^{1}/_{2}$″～$4^{1}/_{8}$″	$3^{1}/_{2}$″～$4^{1}/_{8}$″
7″～$10^{1}/_{2}$″	$3^{1}/_{2}$″	$4^{3}/_{4}$″	$4^{3}/_{4}$″
8″～12″	4″	$5^{1}/_{4}$″～$5^{3}/_{4}$″	$5^{1}/_{4}$～$5^{3}/_{4}$″
9″～$13^{1}/_{2}$″	$4^{1}/_{2}$″	$5^{3}/_{4}$″～$6^{1}/_{4}$″	$5^{3}/_{4}$″～$6^{1}/_{4}$″
10″～15″	5″	$6^{1}/_{2}$″	$6^{1}/_{2}$″
11″～$16^{1}/_{2}$″	$5^{1}/_{2}$″	$6^{3}/_{4}$″～$7^{1}/_{4}$″	$6^{3}/_{4}$″～$7^{1}/_{4}$″
$13^{1}/_{4}$″～$19^{7}/_{8}$″	$6^{5}/_{8}$″	$7^{3}/_{4}$″～$8^{5}/_{8}$″	$7^{3}/_{4}$″～$8^{5}/_{8}$″

1. Well Diameter Dimensions 2. Drill Rod Dimensions 3. Drill Bit Connector Fit Dimensions 4. Serialized Tool Dimensions

Through the process of analysis, it appears that the use made of drill bits and serialized drill bits by the various oil fields of our country is not uniform. Moreover, the differences between old and new oil fields, the differences between the geological conformations of oil layers, as well as the influence of the force of habit, serve to suggest the series of drilling and dredging well tools of our factory, that is:

$$3\frac{1''}{2},\ 4\frac{1''}{2},\ 4\frac{3''}{4},\ 5'',\ 5\frac{1''}{2},\ 6\frac{3''}{4},\ 6\frac{1''}{4},\ 7'',\ 7\frac{7''}{8},\ 8\frac{5''}{8}.$$

After we did an analysis of the trends in serialization, we made an initial trial of the standardization plan which follows, for currently existing products with relatively simple safety couplings. We took the original $6\cdot\frac{1''}{4}$ positive fastening safety coupling series and turned it into $7''$、$6\frac{1''}{4}$、$4\frac{3''}{4}$ positive and reverse fastening dimensional series of six types. Through sales personnel consulting users on their opinions, we discovered that the serialization of products was entirely welcomed by the users. They all had definite amounts of goods to order, and, therefore, they opened a new path to the development of new products by factories. The work of standardization in the diagramming of model products has achieved excellent economic results. (Originally carried in "Weapons Standardization" No. 3, 1983)

"Methods and Realization of the Work of Product Standardization for the 'Iron Horse Automotive Vehicle'"

Air Compressor Factory Standardization Office

In order to carry out the guidance to "unite the military and civilian," the Ministry decided that, in the Sichuan area, our factory should be made into a total product unit, organizing eleven heavy machine product enterprises, which, together, undertook the diagramming and design of the "Iron Horse" (TM) automotive vehicle product. In order to satisfy unit requirements, in 1980, we took the West German Benz 2026 (6x6) cross-country truck as our model. We diagrammed, designed, and test produced three copies of the Iron Horse (TM) SC2030 (6x6) combined military-civilian use cross-country truck. This year, we also took the West German Benz 2626 (6x4) truck as a model specimen, and began the diagramming and design of the Iron Horse (TM) SC3030 (6x4) combined military-civilian use road transport vehicle. At the present time, this project is still in progress. The Benz 2026 and 2623 automotive vehicles are products manufactured by the West German Daimler Company. They possess advanced technical structures which give them outstanding capabilities. In order to guarantee the originally projected technical capability targets, to shorten the test production period, and to develop the production of civilian goods, in the diagramming and design process, standardization personnel were closely integrated. In its execution, we divided the work into the stages outlined below.

1. Standardization Work Before the Beginning of Product Diagramming

In the diagramming and design of automotive vehicle products, the work is technical in nature, there is a lot of it, and it is complex.

Vehicles as a whole have over four thousand parts. These involve eleven factories. The personnel involved are also numerous. How to provide good organization to the standardization work in the diagramming and design of these products is the first step in developing the work. In August, 1980, our factory established a "2026 diagramming and design team" composed of over one hundred personnel from such departments as design, industrial techniques, inspection and testing, and so on. Under the actual supervision of the general engineer, standardization personnel also developed their work within the diagramming and design team.

1. The guiding thought unifying product standardization work in diagramming and design clarifies the direction of the work.

This standardization work in the diagramming and design of products is the first we have run into. What is this guiding thought which relates to standardization work in the diagramming of products? How is it different from the methods and content of work in diagramming design and designing from scratch? Questions such as which types of standards should be implemented are also not specified with sufficient clarity. Through the advanced experience of our brother factories, we integrated the special design characteristics of the Benz automotive vehicles and conducted a real investigation. We recognize that: first, the diagramming and test production of products is done primarily to raise the level of design of specialized products and improve manufacturing technologies. The work of standardization must follow and serve this guiding concept. Second, studying advanced technologies introduced from abroad must implement, in its design work, the principle of "diagramming design to fit our national situation." Therefore, the diagramming and design of products is also the designing of new products. The methods of the work of standardization and its contents are also generally similar to those for the original design of products. Third, the diagramming of products is handled as though it were the original designing of products. It should implement and carry out the currently effective standards of our country. (This includes advanced international and foreign standards.)

2. The creation of relevant guiding technical documents, unifies standard requirements.

According to the principle which treats the diagramming of products as the original designing of products, it is required to implement and carry out the standards of our country as currently in effect. Before research is done on the diagramming design of a product, one first sets out " Detailed Principles of Standardization Inspection of the Blueprints for the Diagramming Design of Benz Automotive Vehicles (Test)" and "Catalogue of Current Diagramming and Design Standards for the 2026 Product (Test)." These two types of guiding technical documents, after going through discussion at a standardization conference attended by nine factories, are further approved by the general engineers, and the various factories test-implement them.

Concerning the aspects of design plan control and quality requirements, automotive vehicle enterprises are implemented and carried out according to the standards of the Ministry of Machine Building. These are not the same as the standards and requirements of the Ministry of Weapons. Because of this, we decided to implement product blueprint serial numbers according to the standards of the automotive vehicle industry, but to handle the aspect of sketch administration according to the standards of the Ministry of Weapons. We selected this type of combined methodology in order to reach the standardization requirements for blueprints. When we set up the "Catalogue of Current Standards," we specified a portion of the basic standards according to national standards, ministerial standards, and industrial standards (a specialized number of standards governing the automotive vehicle industry.) In order to implement the principle of combining civilian and military matters, ministerial standards were chosen to be the standards of the Ministry of Weapons.

Aside from this, this diagramming and designing of automotive vehicle products is a widespread, far-reaching enterprise Looking at it in terms of the design personnel of whom it is composed, there are both new comrades and old comrades. There are also various differences in level. Because of this, we, in detailed regulations, took th relevant standardization requirements and the standards required for their implementation and specified clear regulations. This makes the design personnel at each factory, beginning with their diagramming of products, able, on the basis of unified standardization requirements, to carry out their designs. This makes it possible to take the necessary precautions beforehand in order to prevent bad results.

3. Arrange collections, supply standardization materials, and strictly guarantee the implementation and execution of standards.

In order to guarantee that the standards in the "Current Catalogue" achieved uniform implementation and execution, through our efforts, we collected and purchased through various types of channels, large amounts of national, and ministerial (enterprise) standards, and, through reprinting, supplied them to design personnel offering a complete set of materials of more than 80 types and over 300 sections. This basically satisfied the work requirements of diagramming and design. Besides this, in order to supplement the gaps in DIN standards, we purposely collected various types of test methods including tolerances, fittings, and ferrous metal materials, as well as 235 items of such things as greases and oils for a total of 1552 items of DIN standards in the materials selected. We also collected and arranged a partial standard catalogue of the DIN standards which currently exist in our country, in order to supply to design personnel timely references to use for comparisons. This creates excellent conditions for diagramming and design work.

2. The work of standardization in the diagramming and design phase

The main point of the standardization work in this stage is the transmission and implementation of new national standards and specialized automotive standards, and, taking the current situation in diagramming and design as the point of concentration, to finish the mission currently undertaken in design work.

1. The positive implementation of two new national standards

In August, 1980, when we began the work of diagramming and design, "Geometric Positional Tolerances" GB1182-1184-80 and "Tolerances and Assemblies"GB1800-1804-79 were two national standards which had still not been published. The corresponding serialization tolerances had also not yet been created. Such problems as gauges had also not been properly resolved. And, there were problems with these two national standards. However, in order to assure the advanced nature and reliability of products, we put forward the early implementation of the concrete meaning of the two new national standards. We went through leadership research, criticism by the general engineer, and we decided to implement, introducing what is in the "Current Standard Catalogue." We carried out this work from the three aspects named below: first, on the basis of the promulgation and reference materials for the two new national standards, we took the materials received and, through rearrangement and reprinting we provided them to design personnel for use. This resolved the problem of design personnel not having material. Second, we designated instructors to compile texts of speeches and design wall charts in order to make positive preparations for the promulgation and implementation of the two new national standards. Third, through documents sent down from the factory department, we sponsored study classes for various types of personnel, vigorously promoting the two new national standards. All together there were more than four hundred instances of personnel training participated in.

In the design process, the standardization personnel frequently went into the design rooms (teams) and held mutual discussions with the design personnel on the diagramming site. They responded to questions from the design personnel and various types of questions raised by industrial process personnel.

2. Vigorous implementation of specialized automotive industry standards and the establishment of factory standards

In the diagramming of automotive products, it is necessary to implement specialized automotive standards so that there is only one firmly grasped process from the unknown to the familiar. Take, for example, the problem of serial numbers. Due to the fact that our factory has always operated on the basis of the Fifth Ministry of Machines' "Armored Tracked Vehicle Production Component Serial Number Method," from design plan to the various aspects of production management, there has been a process of turning around. Moreover, everyone has had various differences in their understandings of "Automotive Standard 130-59." The implementation of this has involved considerable difficulty. In view of this situation, we established the practically implementable factory standard "Q/JP2-80 Automotive Vehicle Product Serial Number Method Temporary Regulation," to guide the design work. Due to the fact that we established factory standards, and selected practical measures for their implementation, we caused blueprints of entire products, from components, subassemblies, and assemblies, to spare parts, so all be free of duplication and omissions. Through the mutual coordination of standardization personnel, the implementation results for specialized standards are good.

3. Points of on-site concentration in the work of coordinating diagramming and design

In the diagramming and design of automotive products, the driver's cabin is the key, structures are complicated, the amount of blueprint diagramming work is large, and diagramming methods and machinery spare parts are different. It is necessary to do diagramming on the basis of the specialized automotive regulation JB1449-74. In this regulation which sets standards for the making of blueprints, it is necessary to separately take the three different positions of the automotive vehicle as zero lines, and diagram using the coordinate blueprint method and so on in the directions of height, width, and length. When we run into this type of problem, we normally, together with design personnel, put on-site emphasis on design, do some practical analysis and research with the actual object as a reference, and mutually discuss and coordinate the design.

Through the implementation of new standards and specialized automotive standards, we have made a fact the penetration of the work of standardization into all aspects of diagramming and design. Standardization personnel put emphasis on on-site design. They go into the design rooms (teams) and coordinate closely with design personnel. The method of developing the work of standardization through mutual respect and cooperation is an effective one.

3. The work of standardization inspections of design blueprints

Standardization inspection of product blueprints is an indispensable step in the design planning procedure. It is a primary technique and an important link in the work of product standardization.

"Standardization inspection" is detailed and complicated work requiring strictness and honesty. We must exert every effort, during standardization inspections, to strictly "nold the line," and inspect honestly, discovering problems and remedying them in a timely manner, resolving problems in the draft planning stage. Our method is:

(1) Product design blueprints must systematically be sent through "standardization inspection."

(2) One must cause the "three transformations" status of products to be recorded on "Product Blueprint Standardization Inspection Record Forms."

(3) In standardization inspections, as far as the general run of product standardization problems in product plans is concerned, "signs" are made on the draft plans in order to facilitate changes by the designers.

(4) Standardization problems extending to and related to design structures and product capabilities are resolved through cooperative research with design personnel.

(5) Concerning questions which have already been clearly resolved by implemented standards or "detailed rules," we must be completely unambiguous during standardization inspections.

4. The establishment of a standardization network beginning the development of the work of standardization between factories

1. The specification of job responsibilities and the establishment of standardization network structure

In early 1984, we diagrammed and designed the West German Benz 2626 (6x4) civilian truck, and it was required that we produce a model vehicle during that year. In order to take a firm grasp on this piece of work, we formally set up the "Sichuan 2626 Automotive Vehicle General Design Engineer System." Moreover, within the general engineer system, we set up the structure of the standardization network. The personnel composing the standardization network were formed from comrades responsible for automotive vehicle standardization at eleven factories producing automotive vehicles. Moreover, a specialized conference was called, and discussions ranged through the "job responsibility conditions" of the standardization network, supplementing and perfecting the technical documents relating to standardization. As far as the diagramming of the 2626 civilian vehicle is concerned, the work of standardization in the newly designed SC2030 product also involved the same offices and requirements.

We recognize that in conditions under which many factories combine design, serialization, and production, within the general engineer system, this type of form for the development of the work of standardization is able to cause product design and the work of standardization to be closely connected. This has a positive promoting effect on the guaranteeing of product quality, the raising of economic benefits, and the realization of the "three transformations" requirements for products.

2. Regulating the "faucet" and developing the work of cooperation between factories

The work of cooperation between standardized factories, according to differing circumstances, requires the selection of different types of methods for its execution. In January, 1981, when the work of diagramming the SC2030 product was begun, in order to unify problems of standardization, the work of cooperation was carried out between the five factories on the southern line. This cooperation unified and resolved various types of standardization problems totaling

approximately one hundred plus. In September of 1983, under organization conducted by the automotive vehicle authorities, a complete review was carried out of blueprints for over four thousand spare parts. Besides this, according to the requirements of the design work phase, they respectively convened two specialized standardization conferences, concentrating on and resolving standardization problems. As far as frequently occurring standardization problems at the various factories are concerned, we were all able to supply timely cooperation in order to resolve them. In summary, the solution of standardization problems between factories through various types of methods reduced mutual haggling over trifles, speeded up diagramming and design, and reduced the test production period. Moreover, it is possible to make the blueprints from various dispersed factories arrive at a unified and excellent objective, very greatly increasing the level of product standardization.

To summarize, in the work of standardizing automotive vehicle products, during the last four years, under conditions of short manpower and inadequate experience, we did a good deal of development work both inside and between factories. We also obtained a good deal of experience and received no small amount of training. We realized to a very deep degree, in the whole process of the test production of standardized products, all critical leadership links, and the work of the development of standardization was smooth. It was only necessary for standardization personnel and design personnel to mutually coordinate, and then, problems related to product blueprints and technical documents were relatively rare. Blueprint quality was also relatively good. Therefore, we can say that leadership attention and the close cooperation of standardization personnel and design personnel are important factors in deciding the good or bad quality of standardization work.

(This article is material exchanged at the 1954 work conference of the southwest region standardization association teams.) (Originally carried in "Weapons Standardization" 1955, No. 5)

"The Status of Standardization Work in Our Factory's Development of Electric Meters for Civilian Use"

Jiangbei Machine Factory Technical Section

The electrical meters our factory produces are the [illegible] standard design DD28 type single phase electrical meter. It is one of the products introduced by the Ministry of Machines and [illegible] implementation of Ministry of Machines standard [illegible]. After several years of effort, in the area of product types, the production of electric meters has already gone from a [illegible] type of product to the development of several types. The development has gone from single phase meters to [illegible] single specification to multiple specifications. At the present time, we have basically [illegible] for single phase electric meters in 1.5A, 5A, 10A, 20A, and 40A specifications for three phase [illegible] 1.5A, 5A, 10A, 20A, 40A. In terms of numbers, the [illegible] bulk of the production, which [illegible] a year. In terms of [illegible] been named by [illegible] products. At the [illegible] acceptance inspection, and [illegible] production permit. At present, the [illegible] moving toward international standards. [illegible] equivalent of our using the international [illegible] committee standard IEC521. Therefore, at the present time, the [illegible] of electric meters as it is at the present time, [illegible] tive effects in areas such as the raising of [illegible] satisfaction of user applications and requirements.

1. The work of standardization [illegible]

The product blueprint design stage is the most advantageous [illegible] for the development of the work of standardization

The presentation of comprehensive standardization requirements. The electric meters produced by our factory are made from blueprints made by the Harbin Electric Meter Research Institute and belong to the products introduced by the Ministry of Machines. Speaking from the point of view of our factory, how the work of standardization should be developed for civilian products introduced from abroad is a new problem. In order to insure proper factory [illegible] management, on the foundation of the currently existing standardization management system, and, incorporating the special [illegible] law [illegible] in the production of civilian goods, we produced [illegible] requirements for the work of standardization in electric [illegible]. The first was dealt with the "three transformations" [illegible] electric meters. The second was the [illegible] standards of the Ministry of Weapons, such [illegible] system for product plans, to [illegible] special gauges, patterns, [illegible] of product design materials, as [illegible]. Third was the [illegible] standards, for example, the [illegible], the order of review [illegible], and correctly executing standards for industrial [illegible]. [illegible] necessity to implement national [illegible] "[illegible] and Assembly," and "Positional [illegible]," and [illegible] that our original standards should be [illegible], for example, product standards, test method standards, [illegible] special materials, and so on. Next is the necessity to [illegible] new items of standardization.

In order to put these comprehensive requirements for standardization into effect, we selected the several measures which follow. The first is to utilize various methods to develop advertising activities. Of the personnel who made electric meters and participated, the majority were temporary people who had never made the product. They were also not very familiar with the "three transformations requirements" pertaining to products or with their management or designs. It is necessary to carry out an information program to make the personnel concerned familiar with and firmly grasp the standards involved. Second is the need to enter deeply into the actual design activities as they occur, assisting design personnel in implementing standards and resolving practical problems. Third is to carry out checks and final inspections of product plans and design documents, guaranteeing that they meet the "three natures" and "three transformations" requirements for product plans and design documents.

2. Collecting and presenting standardization materials. Standardization materials are important data for design, production and management work. When test production of electric meters is begun, the only standards materials that one has are the product plans from the Harbin Electric Meter Research Institute. There are no other materials. Moreover, because our factory handled the production of military products for a long time, our standards materials concerning the production of civilian products are very limited. Because of this, the collection of standards materials concerned with electric meters is a problem urgently requiring a solution. On the basis of the requirements for the test production of electric meters, through various types of channels, we collected a total of 87 product standards, standards of test analysis, and quoted standards. At the same time, on the basis of enterprise standards collected from outside units, we established two standards for our own enterprise. These standards not only provide a basis when plans are drawn for electric meters. At the same time, they also provide adequate conditions for the technical preparations for production of electric meters and the subsequent obtaining of licenses for the production of the meters.

(II) The work of standardization in the technical preparation stage of electric meter production

The requirements for standardization in the process of technical preparation of electric meters make use, to the largest extent possible, of current standards for industrial techniques and equipment. However, our factory's current standards for industrial techniques and equipment were all established under the conditions associated with the production of products for military use. These types of industrial techniques and those types of industrial equipment, as well as their associated dimensional specifications cannot satisfy the requirements for the production of electric meters. In order to put our electric meters on the market as soon as possible, we assembled the production requirements for the electric meters and set up planned standards for industrial techniques and equipment.

Looking at the product as a whole, the total number of types of industrial equipment involved is 1449. Among these, standardized industrial equipment accounts for 785 types. The coefficient of standardization reaches 54%. The economic effectiveness is calculated according to the formula provided by the national standard "Evaluation Principles and Calculation Methods" (GB3533.1-83) with the net savings of funds reaching 60797. Therefore, one can see that the work of standardization is not only able to speed up the test manufacture of electric meters and production technology preparations, but is also able to greatly increase economic effectiveness.

II. The establishment of internal control standards and the creation of products of excellent quality

Civilian use electric meters are a type of measuring instrument. The accuracy required in them is high and its measurement precision must be reliable. Its quality impacts on the profits of tens of thousands of people. It is necessary to stringently maintain product quality in order to satisfy the requirements of user applications.

In the initial period of the production of civilian use electric meters, due to the fact there was a "put emphasis on civilian products over military products" type of thinking, and, in response to continual increases in the numbers of products, one saw the unceasing appearance of problems with product quality. A good number of consumers voiced complaints. Some sent their electric meters back which affects user applications and the good name of our factory. The repercussions of this for our factory were very great. This forced us to recognize that the handling of civilian products was not that simple--that in several respects one could say that they are more difficult than products for military use. Because of the fact that the numbers of military use products are all bought up by the government, in terms of quality, there is only one user. The products only have to meet the military representatives acceptance inspection, and there is no problem. However, the numbers of civilian products is influenced by market fluctuations and competition. In terms of quality, they are inspected by tens of thousands of users. Therefore, it is only with user satisfaction that these products really can be considered up to standard or of high quality. In order to resolve this problem, we decided to set up internal control standards for electric meter products. In setting up our internal control standards, we gave primary consideration to the several points and principles below:

1. The principal technical standards involved with internal control standards, and their function parameters, are higher than the currently effective Ministry of Machines standard (JB799-79). From the production of spare parts to the coordination and testing of finished products, their checking, and acceptance inspection, right through the process of their sale, we established twenty-two internal control standards for the dimensional specifications of principal spare parts and functional parameters for product surfaces, in order to minimize to the greatest extent possible discrepancies in product quality.

2. The principal technical standards of internal control standards, their functional parameters, and overall standards must satisfy user requirements. According to the regulations of the current Ministry of Machines standard (JB793-78), the only regulated functional parameters are those such as electric meter parameters for the amount of electricity, sensitivity, and latent movements. Moreover, there are no specific regulations for electric meter noise either. However, user applications and requirements are different. Electrical components and standard measuring components have relatively higher functional parameters for such quantities as the amount of electricity, sensitivity and latent movements. Moreover, individual users impose special requirements for electric meter noise. When setting up internal control standards, it is necessary to consider these different requirements and take these various types of technical targets and function parameters and regulate them to optimum adjustment levels. Moreover, as far as the question of electric meter noise is concerned, there is a requirement to adjust to minimum levels in order to reach noise elimination.

3. The establishment of internal control standards must be broad, strict and appropriate. It must also consider conditions as they currently exist as well as level of advancement. For example, the controlling of problems with electric meter noise and the resolution of quality discrepencies are things which must be strived for before they can be achieved. Because of this, we presented the requirement for comprehensive standards.

Not only is it necessary for internal control standards to have strict technical targets and functional parameters. It is also necessary for them to have concrete methods of implementation in order to precisely guarantee the implementation of the control standards.

When electric meter products go out of our factory, they undergo strict testing according to internal control standards. The internal control standards established are not made on the basis of specified goods. They are only made on products actually leaving the factory. This guarantees that parts which do not meet the internal control standards do not leave the workshop and that products which do not meet internal control standards do not leave the factory.

From the time that electric meters are produced in accordance with internal control standards, the rate of excellent quality products produced and the rate of products passing transfer inspections obviously increases. These products also achieved user satisfaction, and raised the reputation of the products. Supply falls short of demand. The actual system in operation causes us to realize a situation in which products which are only produced in accordance with production standards are not of high quality, but only just reach the lowest product requirements. If one is thinking in terms of raising product quality, then, it is necessary, on the basis of currently existing standards, to raise the level and establish internal product control standards.

III. Excellent Testing Techniques Guarantee the Accurate Transmission of National Quantity and Value Standards

One important condition for guaranteeing and increasing product quality is the strengthening of the work of the inspection and testing stations, unceasingly improving inspection techniques, guaranteeing the accurate transmission to factories of the various types of national quality and quantity standards, and maintaining the accuracy and stability of standards.

In the case of our factory's inspection and testing station, before the Ministry invested its money, the factory used something over 200,000 yuan in supporting funds for the station in order to add equipment Moreover, we appointed additional inspection and testing personnel. They not only undertake the mission of inspection and testing of electric meters from our factory. At the same time, they also undertake the specialized inspection and testing work for introduced electric meters. Through the efforts of several years of

[illegible] reorganization and improvement, we have developed from the original direct current test capability to an alternating current test capability. In such areas as inspection and testing means, as well as quantity and quality value transmission, and electric energy measurements, we basically formed a guarantee system. Besides that, we established a technique for proofing standard electric meters as well as an electrical energy standard transmission system chart. At present, our testing has reached the stage of:

1. The various types of quantities and values (length, temperature, mechanical, electromagnetic, and so on) are all capable, in accordance with standards, of undergoing normal transmission. Moreover, they are periodically evaluated, implementing a guaranteed rate of inspection for specialized tools reaching 100%, and a rate of inspection for universal tools reaching 99.5%. The inspection rate for instruments and tools reaches 100%.

2. Precision of electrical energy standards. The accuracy standard for single phase electrical energy coming from the producing station and after [illegible] national standard comparisons and product permit [illegible] overall deviation of smaller than 0.3%. The accuracy standard for three phase electrical energy is an overall deviation of .37%.

3. The power standard precision is 0.02%.

4. We developed inspection tests for mutual inductors, tests for power factory meters, tests for the precision of various power sources, as well as similar work on the evaluation of the electromagnetic properties of magnetic materials to guarantee the implementation and maintenance of power source standards.

IV Taking aim on advanced world levels and agressively selecting for use international standards

Aggressively selecting for use international standards and advanced foreign standards is currently an important technical policy. Whether or not enterprises earnestly adopt these for use is the key to the success or failure of the various enterprises in the future competitive market. The electric meters which our factory produces, due to the fact that it carries out production strictly according to internal control standards, have already arrived at the national level of excellent quality products. However, when one compares them to the

advanced international level, there is still a very large gap. In order to exceed the advanced world standard, we have agressively adopted international standards. Our factory has decided to make our single phase electric meters equivalent to the use of the international electrical engineers committee, IEC, standards. The projects which our factory is now engaged in are:

1. Setting up programs. On the basis of the actual level and production conditions of the factory, we established a factory program for the adoption of international standards. We decided to reach the level of international standards for the quality of single phase electric meters before 1985. Moreover, we adopted international standards and integrated them into the scientific and research projects of our factory departments (one character unreadable). We appropriated funds and established training teams. In this way, the work of the adoption of international standards was developed and basically insured.

2. The collection of international standards and advanced foreign standards. The collection of standardization materials is the basis for the adoption of international standards and advanced foreign standards. We collected, by various routes, eight types of standards from the international electrical engineering committee (IEC), eight types of Japanese electric meter standards, and two types of Soviet electric meter standards. We carried out a thorough analysis of the standards we collected, and we began to understand the general situation relating to IEC standards and the electric meter standards of technologically developed countries. In order to adopt international standards and the standards of advanced foreign countries, we made technical preparations.

3. Finding the differences. Comparing the general IEC standards to those Ministry of Machines standards currently in effect, in the overall production situation of our factory, there were eleven requirements which were basically the same. They were simple to comply with. There were six which required the undertaking of testing and validation. Among these, there were three which considered current product status and domestic conditons of application, requiring repeated rounds of validation. Besides those, there were another three requirements which were very far from the IEC standards. These required definite progress in design structure and industrial techniques. (Originally carried in "Weapons Standardization" 1984 reprint)

"Product Designs Should Have As Many Interchangeable, Standardized Parts as Possible"

Yong Hong Machine Factory Hwang Xiungchang

When enterprises carry through and implement the guidance to "readjust, revolutionize, reorganize, and improve," what kind of new forms are appropriate to the production of more, better and faster products suitable for sale in order to satisfy the needs of society is a subject which we need to research. From practical application, we learn that, in the process of product design, it is only necessary to do a comparative analysis of many types of products and one discovers, in those products, many parts which can be interchanged. There are also parts with structural sections that are similar. In this type of situation, realizing the interchangeability and standardization of product parts has an important influence on increasing production, lowering production costs, and speeding up production.

Several years ago, our factory turned its hand to the implementation of the production of products for civilian use. Moreover, we developed a single type of product into a large number of product types. The product types and their number were selected and decided upon on the basis of the needs of society and the actual production capabilities of our factory. Initially, we produced N3810 type automotive vehicle transmission rear axles. Later, the product went through market research. Automotive transmission rear axles with surge gates were even more attractive to users. In order to expand the product types, it was decided to carry out the work of test manufacture on this product. During design, earnest analysis and comparison of the whole structure of these two types of products gave rise to discussions in which the course of interchangeability and standardization, except for important new designs of such important parts as planetary gears, axle casings, and surge gates, all the rest adopted interchangeable and

standardized parts. Of 155 parts, [illegible] of them were [illegible] interchanged. 64 were standardized. Due to the fact that interchangeable and standardized parts were [illegible], the [illegible] of clips reduces the 77 assemblies on the [illegible] assemblies. The use of specialized measuring [illegible] to 26. And, the use of specialized cutting [illegible] to 25. There are 399 types of cutting and measuring [illegible] for use at various levels of standards. The [illegible] and manufacturing period, and guarantees that [illegible] mutual interchangeability. The [illegible] that the coefficients of interchangeability [illegible] high, within a relatively [illegible] new products to [illegible].

[illegible]

appropriate forms changes were made in such parts as the main
frame, the frame, and the chain cover. Moreover, we
our vibration prevention systems. From the design to
samples of sample vehicles, we used less than two months
, at the Taiwan, Yinxing trade exposition, these
very favorable comments. This opened a fortunate
prelude of our factory.

"[illegible] brand moving Steel Saw Frame", which is
widely sold in markets both inside and
, foreign businesses have presented the
, within a short time, of a type of
. When making a new design for
interchangeable parts, and all of our parts
[illegible] fastening patterns in
safety production. This greatly
, and caused this product to be very easily
.

[illegible] of production, we learned that
as possible of interchangeable
to say that, on the foundation
specialized parts in products
. Interchangeable and
as possible. [illegible]
the enterprise production adapt to
, promote to short-term objective [illegible], and
correct place. Carried in "Weapons
[illegible]

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